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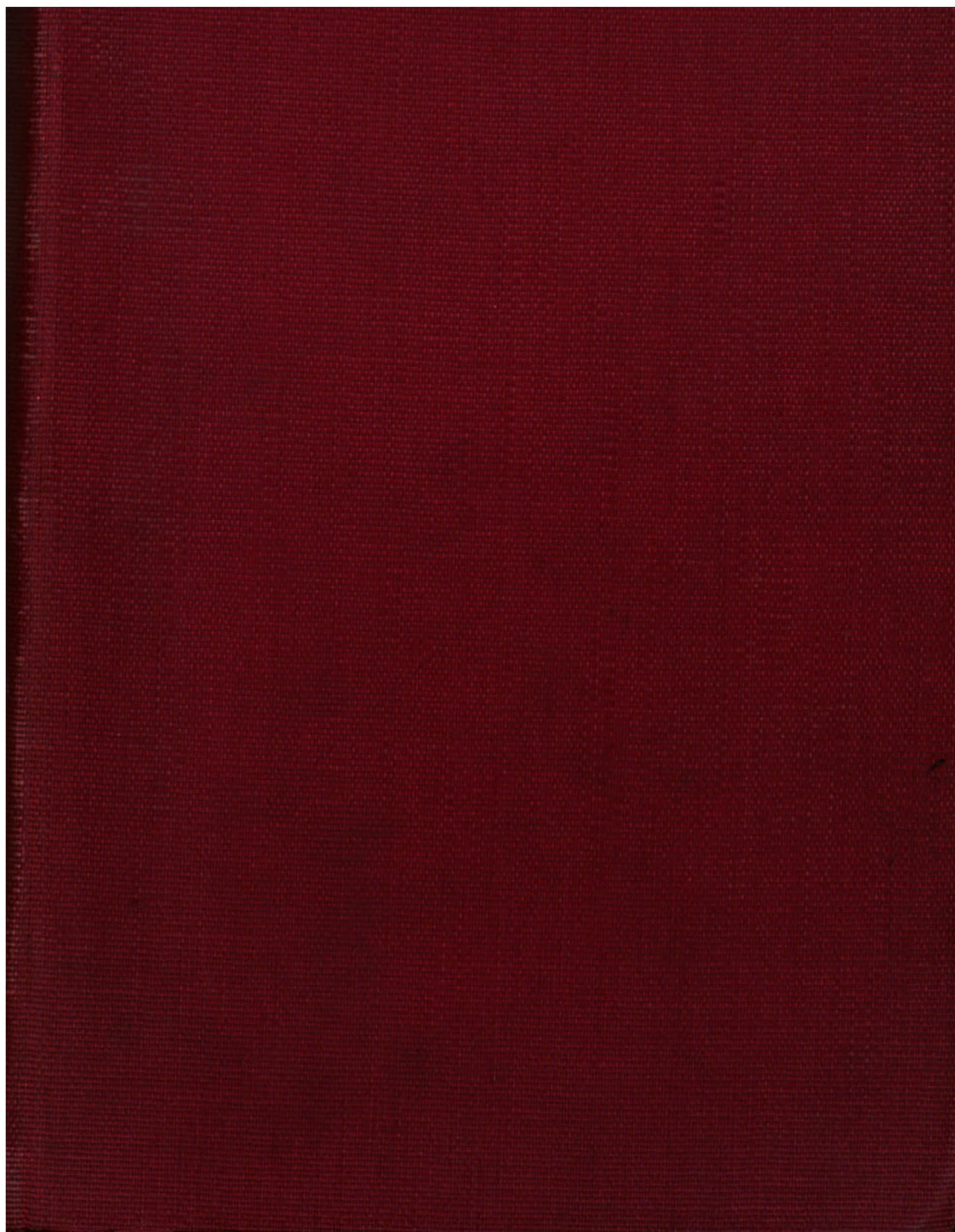
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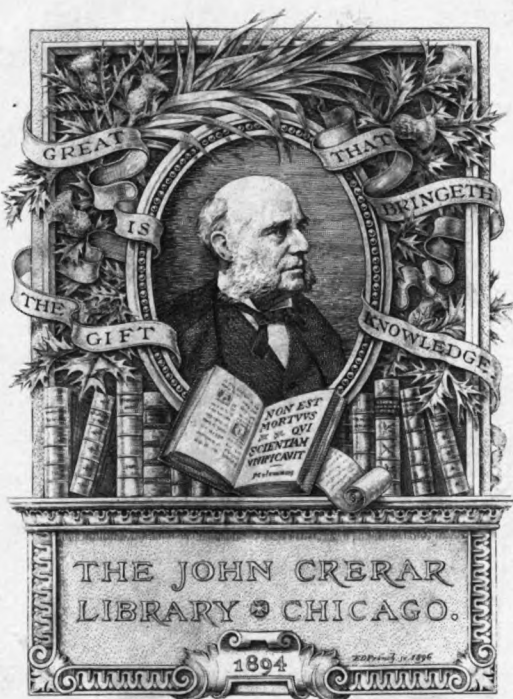












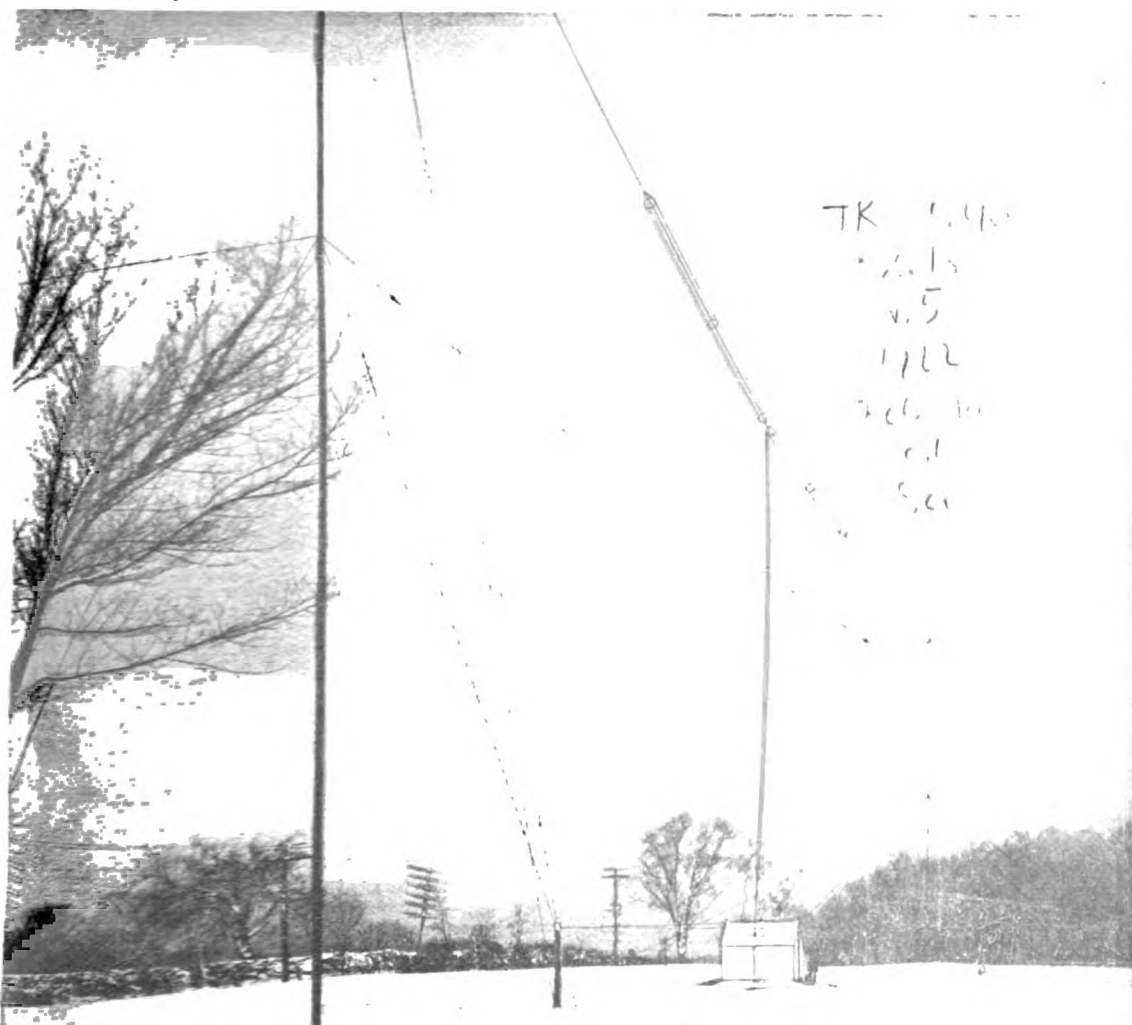






# QST

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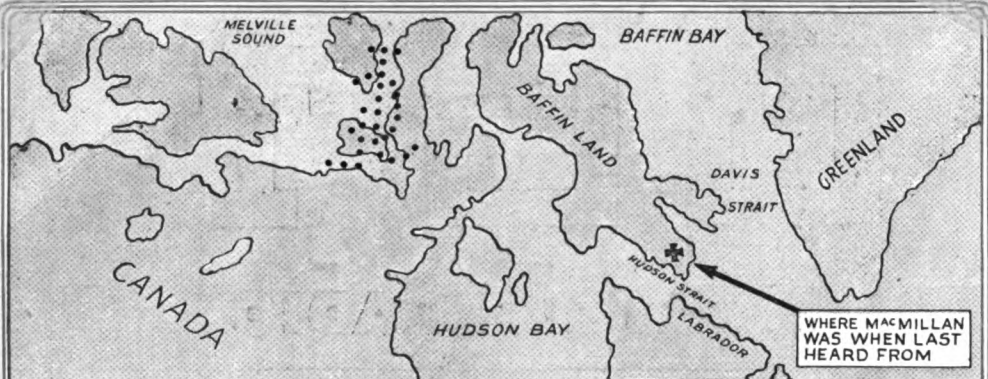


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**FEBRUARY 1922**  
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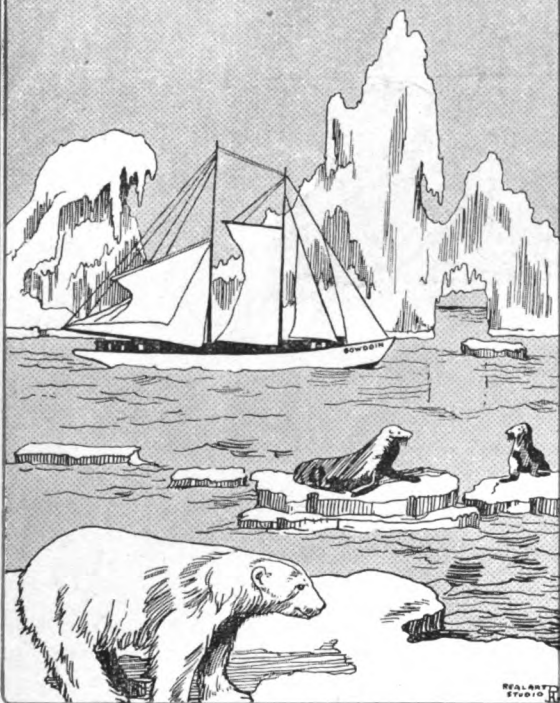
—"Upon our arrival today 1224 geographical miles north of Boston, we tested our wireless and were delighted to hear at least a dozen stations. We hear the Annapolis station every day at noon and at 10 P.M. when time signals are sent broadcast. I think we are the first arctic expedition to ever keep in touch with home, (bringing to our minds possibly the fact that while we are apparently in a world unfinished or now long dead, far to the south of us there is another world, progressive and throbbing with activity.) The musical little note that reaches our ears nearly every minute of the day is a constant reminder that we are a part of the world and not forgotten . . . "When in winter quarters we shall put up a larger antenna and undoubtedly keep in touch with home through the year."—Excerpt from MacMillan's story to the "Boston Globe", Dec. 4, 1921.

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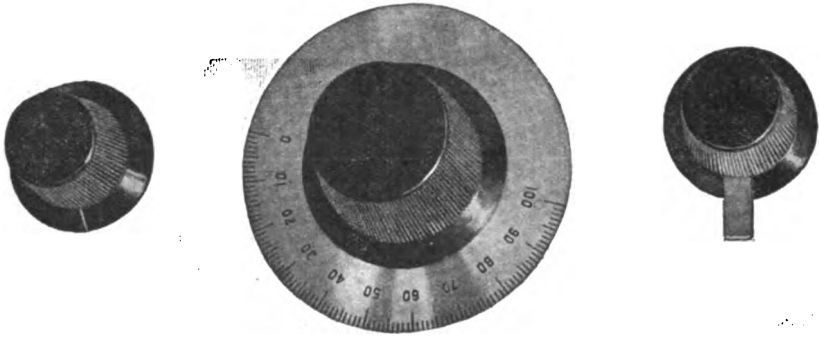
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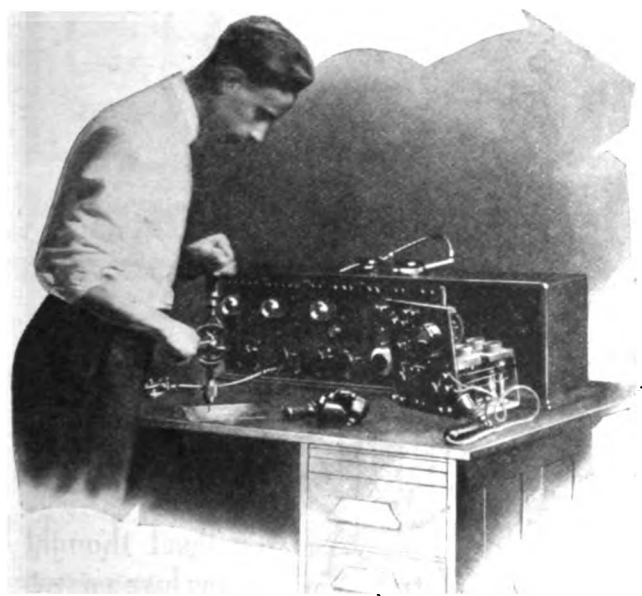
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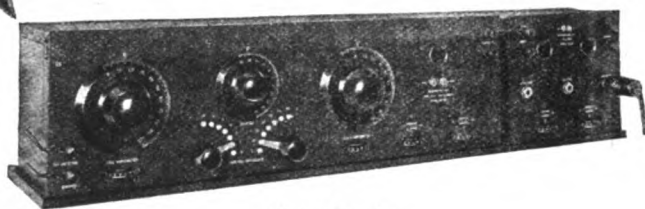
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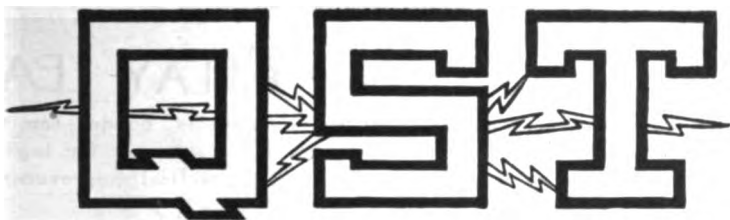
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# The Official Organ of the A.R.R.L.

VOLUME V.

FEBRUARY, 1922

No. 7

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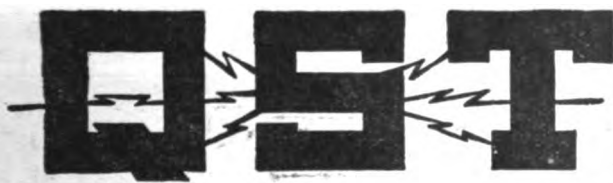
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A Magazine Devoted Exclusively to the Radio Amateur

## The Story of the Transatlantics

By The Editor

**T**HE signals of some thirty-odd American amateur radio stations, working on the short wave lengths and low power permitted amateurs, were heard across the Atlantic Ocean in the second series of Transatlantic Sending Tests conducted by the American Radio Relay League in December, 1921. This is a story of that achievement.

### The First Attempt

The possibilities of transatlantic tests were first presented to the amateur world in 1920 by Mr. M. B. Sleeper, at that time radio editor of "Everyday Engineering". It is a subject that intrigues the amateur—his greatest desire in life is to get "distance" with his equipment. It has wonderful possibilities, too, in opening the way to world-wide amateur radio. The arrangements for the first tests in February of 1921 were going merrily along, then, when "Everyday Engineering" unfortunately was obliged to suspend publication. Mr. Sleeper requested the A.R.R.L. to take over the management of the tests, which it did in order that his splendid idea might not be lost. In the limited time remaining after our Operating Department took over the management it was not possible to perfect arrangements as we would have liked, and the tests failed. Looking back at them now we believe we can ascribe this to two causes: the length of time assigned the transmitting stations was altogether too short, and most of them were spark stations. At any rate no signals were received which unquestionably could be attributed to American stations.

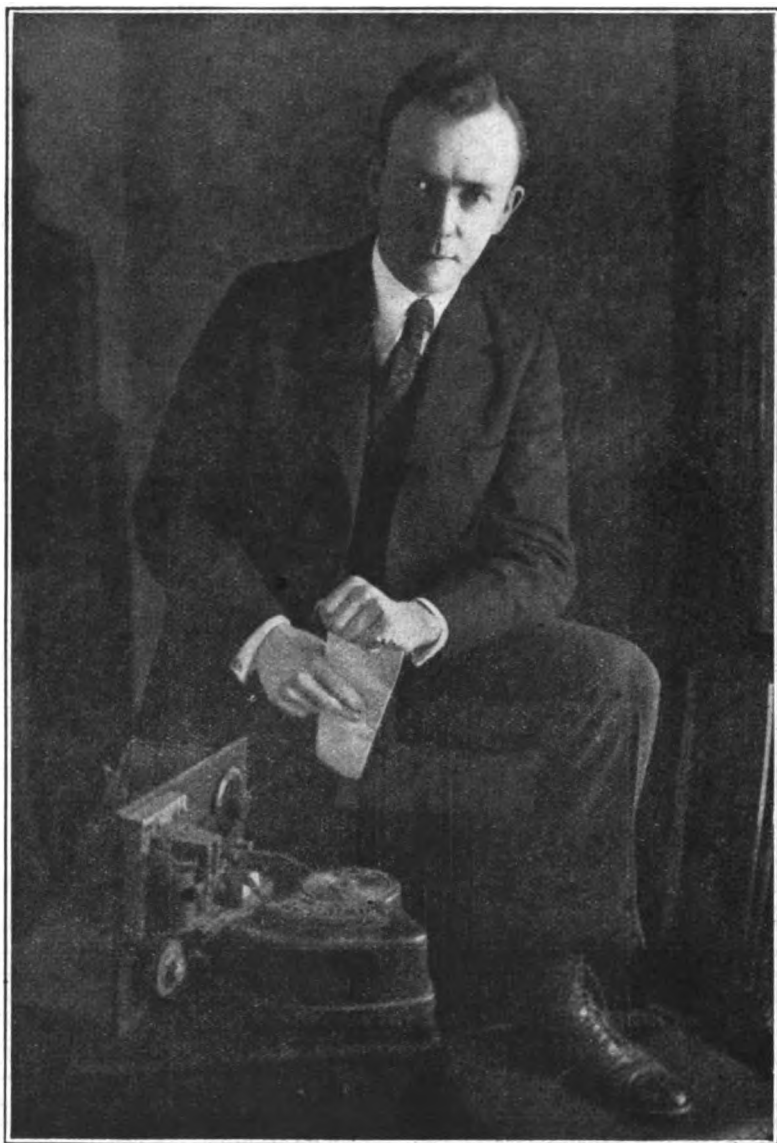
American ship-operators on transatlantic runs had heard our signals on the other side, however, and we of the A.R.R.L. were still firmly of the belief that signals could be got over on schedule. Gradually the determination crystallized to try it again,

and we even made the boast in print that if a dyed-in-the-wool American ham could be sent across the water with a good American regenerator we knew signals could be copied; in fact, we bet our new spring hat on it. Ever since then we have been answering inquiries from England as to just what a "ham" is, particularly one who has been dyed while still in the wool. But we're used to questions.

### To Try Again

And so the matter of additional tests was taken up with Mr. Philip R. Coursey, assistant editor of "The Radio Review", London, who had managed the British end of the first tests, and he, finding British amateurs desirous of giving the game a second go too, kindly agreed again to look after the reception end, which this year was perhaps to include France and Holland too. Plans went forward during 1921 and a brief announcement appeared in July QST, while an open invitation to all amateurs to enroll for the preliminary tests was published on page 12 of QST for September, in which the plan was explained and registration form appended.

About this time our First National A.R.R.L. Convention was held in Chicago and our Board of Direction had a meeting there at which plans for the forthcoming tests were considered. Since we were tackling the job we wanted to do a real good job of it and avoid any chances of a second failure. The desirability arose, then, of sending an American listener to Britain to supplement the efforts of the British amateurs, not only so that we might have a double chance of success and so that some comparisons might be made of the relative sensitivity of American and British amateur apparatus but also for a much more important reason—it would then be possible to make the tests really democratic,



**PAUL FORMAN GODLEY**  
**A.R.R.L.'s Successful Overseas Listener**  
from a recent photograph taken at his home  
in Cedar Grove, New Jersey

as befits our organization, for if only picked stations were to transmit on schedule, obviously the number would be limited, whereas if we could have an A.R. R.L. man there, one used to twirling a mean variometer all night long, the tests could be made a great popular event with free-for-all periods in which the whole country could be invited to participate. This idea was favorably considered and funds were appropriated to send a man to England to make it possible. An invitation was extended Mr. Paul F. Godley, of Montclair, N. J., to undertake the mission in the name of American Amateur Radio, and he was kind enough to accept. Mr. Godley is the man who first adapted the Armstrong regenerative circuits to short-wave work; he originated the variometer regenerators which have made possible the wonderful short-wave DX work of American amateurs since 1914; and he was chosen to go overseas because in the unanimous opinion of the Board he was America's most expert operator in the practical reception of short wave signals. Let it be clearly understood that an American representative was not sent merely because we feared the English amateurs weren't seasoned operators or weren't able to get us with their equipment; instead it was in order that the tests might be expanded into a big popular event without asking the British amateurs to stay up *all* night every night; and Mr. Godley went over as an auxiliary to the British efforts. The French magazine "La T.S.F. Moderne", commenting on the arrangements, suggests that we feared the British weren't sufficiently the hard-boiled owls, but that wasn't it. Incidentally, fellows, you ought to see the French for boiled owls: "des oiseaux nocturnes durs a cuire", literally, "nocturnal birds hard to cook". Have a hi wid us on tt, you tough nocturnal ornithic persons! The big idea was to make sure that American signals got thru to Britain, so that the possibilities of transocean amateur work might be helped along, and that is why Godley was sent.

#### The Preliminaries

Altho it was decided to divide part of each test night into free-for-all periods it was obviously desirable to give our best stations individual schedules of considerable duration so that careful tuning could be done in Britain and positive reception be recorded. To pick the best stations which would be assigned such individual schedules, eliminating tests were conducted, and the announcement in September QST was an invitation to enter these preliminaries, the books being kept open until Oct. 12th. The hours being limited, there was time for only the better stations in these individual final schedules, and the preliminary qualification was that the

stations cover 1000 miles overland. Seventy-eight stations were entered in the preliminaries, which were conducted Nov. 1st to 5th, inclusive, an advance over the original dates made necessary by Mr. Godley's earlier sailing. The time being quite limited, arrangements for the preliminaries were conducted entirely by mail, without chronicle in QST. Instructions were given the transmitters and a thousand copies of the schedules distributed to picked receiving stations thruout our Operating Department with instruction to notify the Traffic Manager direct of all reception. Nov. 10th was set as the final date for the reception of qualifying reports, as the schedules had to be made up in advance of Mr. Godley's sailing. A station did not have to be reported by an official recorder to be eligible in the finals, however—any evidence that it had covered the requisite 1000 miles was sufficient. A number of stations participating in the prelims were heard over a thousand miles and have cards to prove it but still did not qualify, as the cards either came to them instead of to this office, so that no proof was offered, or came to this office too late. Some excellent stations, such as 1UN for example, failed of qualification thru such an accident. Other stations qualified at the last minute by rushing evidence to us, among which was 1AFV who, altho not reported a thousand miles by any of the recorders, filed a card with the Traffic Manager which showed he had covered the DX. Everyone who could show by Nov. 10th that they had made the grade was given a place in the finals, but for fairness' sake the Operating Department held rigidly to the original announcements.

#### The Finals

The complete scheme for the tests was published on pages 29-32, inclusive, of October QST. For six hours each night for ten successive nights, December 7th to 16th, inclusive, transmission took place and watch was kept on the other side. Each six-hour schedule was divided into two parts, the first part, from 7 p.m. to 9:30 p.m., Eastern Standard Time, being the free-for-all, consisting of ten periods of 15 minutes each and in each period of which all the amateurs in a given inspection district called "Test" and signed. The periods were rotated so that every night a district sent at a different time, sometimes early in the evening, sometimes late, so that if the hour mattered all would have an equal chance. The schedule for these periods appeared on page 30 of QST for October.

Then the second part of each of the six nights, from 9:30 p.m. Eastern Standard Time to 1:00 a.m. of the following date, was devoted to the individual stations who qualified in the preliminaries. Sealed secret



cypher combinations were assigned these stations, with a request that they not be opened until the first night of the tests, and no information was given out as to who had qualified except to the successful contestants themselves.

The following table lists the entrants in the finals:

| Call | Location             | Type | Wave | Cypher |
|------|----------------------|------|------|--------|
| 1AFV | Salem, Mass.         | C.W. | 200  | YLPV   |
| 1TS  | Bristol, Conn.       | C.W. | 200  | AOTRB  |
| 1RU  | W. Hartford, Ct.     | C.W. | 200  | BPUSC  |
| 1DA  | Manchester, Mass.    | C.W. | 200  | CQVTD  |
| 1AW  | Hartford, Conn.      | Spk. | 210  | DRWUF  |
| 1BCG | Greenwich, Conn.     | C.W. | 230  | GODLY  |
| 2BML | Riverhead, L. I.     | C.W. | 200  | FSXVG  |
| 2FD  | New York City        | C.W. | 200  | GTYWH  |
| 2FP  | Brooklyn             | C.W. | 200  | HUZXJ  |
| 2OM  | Ridgewood, N. J.     | Spk. | 200  | JVAYK  |
| 2EL  | Freeport, L. I.      | C.W. | 200  | KWBZL  |
| 8DH  | Princeton, N. J.     | C.W. | 210  | LXCAM  |
| 4GL  | Savannah, Ga.        | C.W. | 200  | MYDBN  |
| 8BP  | Newmarket, Ont.      | Spk. | 200  | NZFCO  |
| 8DR  | Pittsburgh, Pa.      | C.W. | 200  | OAGDP  |
| 9KO  | St. Louis, Mo.       | Spk. | 200  | PBHFQ  |
| 9AW  | Toronto, Ont.        | C.W. | 200  | QCJGR  |
| 1ZE  | Marion, Mass.        | C.W. | 375  | RDKHS  |
| 2ZL  | Valley Stream, L. I. | C.W. | 325  | TGMKU  |
| 3ZO  | Parkesburg, Pa.      | C.W. | 360  | UBNLV  |
| 8ZZ  | Blackwell, Okla.     | Spk. | 375  | VJOMW  |
| 6XH  | Stanford U., Cal.    | C.W. | 375  | WKPNX  |
| 7ZG  | Bear Creek, Mont.    | Spk. | 375  | XLQOY  |
| 8XK  | Pittsburgh, Pa.      | C.W. | 375  | YMRPZ  |
| 9ZY  | Lacrosse, Wis.       | C.W. | 260  | RZQMY  |
| 9ZN  | Chicago, Ill.        | Spk. | 375  | ZNSQA  |
| 9XI  | Minneapolis.         | C.W. | 300  | SFLJT  |

The three and a half hours for individual schedules was divided into fourteen periods of 15 minutes each, and times assigned to each station, the periods again rotating for fairness. At a suggestion from Mr. Godley the individual stations for the most part transmitted in groups on the same wave length, two stations sending at once permitting double the time for each without jeopardizing the chance of either to be heard. Most of the special schedule stations transmitted in pairs, three being the maximum going in any one period.

#### In England

These arrangements were by no means for the special benefit of Mr. Godley but were to govern the entire tests. The arrangements in England were entirely in Mr. Coursey's hands and the data on the schedules was communicated only to him. To avoid all criticism Mr. Godley was told nothing except the free-for-all schedule, which was public information, but Mr. Coursey supplied him with a schedule of the times and wave lengths on which to listen, the same as he broadcasted to all British listeners, and kept strictly to himself the identity and cyphers of the various stations. Mr. Coursey being in complete charge, Mr. Godley was on practically the same status as any British listener and was required to submit his reception to Mr. Coursey for verification and to report thru him.

Meanwhile the greatest enthusiasm seems to have greeted the preparations for the tests, on the other side. The Neder-

landsche Vereeniging voor Radiotelegrafie (Holland) wrote us for particulars and published them in their magazine, "Radio Nieuws", together with recommended Armstrong circuits for short-wave reception; and "La T.S.F. Moderne" did the same thing for the French amateurs. "Wireless World" was the bulletin for the British amateurs, and it was here, of course, that the highest interest centered. Many amateurs seem to have gone to great lengths in their preparations, making special sets with many stages of tuned-output radio amplification—and we are very happy that the outcome of the tests justified their labor.

#### Godley Prepares

While these arrangements were progressing "Paragon Paul" was busy too, building special amplifiers, testing various tuning arrangements, and experimenting with different aeriels. When he succeeded in making 5ZA work a relay in New Jersey without interference from New York amateurs he felt he had things around where they belonged.

On Nov. 14th, the night before he sailed, a very impressive little dinner was given for him at The Engineers' Club in New York City, where our A.R.R.L. officers and our directors within hailing distance and the officials of other radio organizations gathered to wish him success and bid him Godspeed. While the trial was to be a severe one and no man could with surety predict the outcome, optimism was distinctly the keynote and everybody was certain that if it could be done at all Paul would get signals. At this meeting credentials and written instructions were given him, together with a sealed packet for Mr. Coursey in which the secret codes and final schedules were given. There were but two copies of these documents in existence and the duplicate was locked in the Hartford safe. Until the writing of the article it was seen by no eyes in this country save those of our Traffic Manager—not even by the present writer.

Godley sailed on the "Aquitania" on Nov. 15th, amid cheers and waving handkerchiefs of assembled radio friends and relatives, and for a couple of nights out the amateur air was thick with farewells and good wishes for 2ZE, Godley's home call, for everybody knew he would be in the static-room on the "Aquitania".

The second day out we radioed him:

"Bon voyage The entire radio world is pulling for you"—to which he replied:

*Confidence increases as distance squared  
Broadcast my heartfelt appreciation.*

Arrangements had already been made with the British authorities thru the kind co-operation of our own State Department and Department of Commerce for special authorization to Mr. Godley to bring in

apparatus and erect and operate a receiving station, and to one familiar with the British laws on radio it will be apparent that this was itself an accomplishment. Mr. Godley landed at Southampton on the 21st and proceeded to London, where he was shown every courtesy by the British radio men. He had originally planned to make use of the receiving station of Commander Phillips, near London, which was kindly placed at his disposal, but results there being discouraging he moved up into Scotland and located at Ardrossan, a thriving ship-building port and watering place on the coast to the west of Glasgow. There he erected his apparatus, accompanied by his official listener, Mr. D. E. Pearson, District Inspector of the Marconi company at Glasgow, who stood a constant watch



The Site at Ardrossan—Note the Tent.

with him during the tests and verified the reception of every signal.

Time was growing very short when Godley arrived at Ardrossan and there was no opportunity to build a shack or make any particular arrangements for comfort. Unfortunately the only good location was in an open field without buildings, and a tent was the only possible housing. This record-breaking reception, then, was done in just a tent, exposed to the elements, its only light a lantern and its only heat an oil stove, while the countryside rocked in the worst weather imaginable—cold and penetratingly raw, terrific down-pours of rain, and wild gales—the results of a cyclone which passed nearby. The physical strain and suffering must have been intense. What a debt we owe Godley for what he went thru for us!

Meanwhile it had been planned to file a message daily at Carnarvon, Radio MUU, addressed to the A.R.R.L. at Hartford and containing a brief report of reception or conditions. So great was the interest of the commercial companies in our undertaking that the Marconi officials very kindly arranged to send this report at a specified time daily, 7 a.m. British time or 2

a.m. Eastern Standard Time, and do it slowly by hand, so that the amateur world could copy it direct and so get first-hand word from Godley at the earliest possible moment. November QST told of this and gave suggestions on the reception of MUU. Carnarvon's signals are not very easy to receive, however, and so it was arranged that Godley should send "PC" messages, which means that they were to be repeated back for verification, and on this side of the water the same brand of very interested co-operation which marked the attitude of the Marconi officials in England was evident in the Radio Corporation folks and special arrangements were made that WII, the Corporation station at New Brunswick, should slowly repeat Godley's messages upon their receipt immediately after 2 a.m. Eastern Time. This made it possible for every amateur to get the dope instantly, and altho announcement of the arrangements was not published it was telegraphed our Division Managers and broadcasted thru the divisions by radio, so that thruout the country there were watch parties every night of the tests.

#### The Results

The tests are now a matter of history. In this issue we publish Mr. Godley's complete report, a wonderful document, which tells the interesting story from his end, and we do not intend to scoop it in this poor chronicle. His daily radio reports,

which were delayed 24 hours thruout the tests, really told the story. These reports, by the way, were filed over his name by Mr. Coursey, Mr. Godley wiring coded reports of his reception to Mr. Coursey for checking, after which the latter passed them on to us.

Eight British amateurs were successful in copying American signals, and that is something that pleases us immensely. At this writing we have not yet received any detailed report from Mr. Coursey but he cables us that the secret codes were correctly copied by British amateurs from 1AFV, Salem, Mass.; 1BCG, Greenwich, Conn.; 2FP, Brooklyn; 2ZL, Valley Stream, L. I.; and 2BML, Riverhead, L. I.; that during the free periods they copied 1UN, Manchester, Mass.; 1RU, West Hartford, Conn.; 1XM, Cambridge, Mass.; and 2ZC, South Orange, N. J.; and that it is probable that 1ZE, Marion, Mass., and 2ZU were also heard; a total of eleven stations. Mr. Godley brings back the rumor that 1DA, Manchester, Mass., was also copied by the British amateurs but Mr. Coursey makes no mention of it. 1BCG was heard

by five British stations. It is very interesting to note that all of these stations are C.W.—not a spark was heard by the British amateurs.

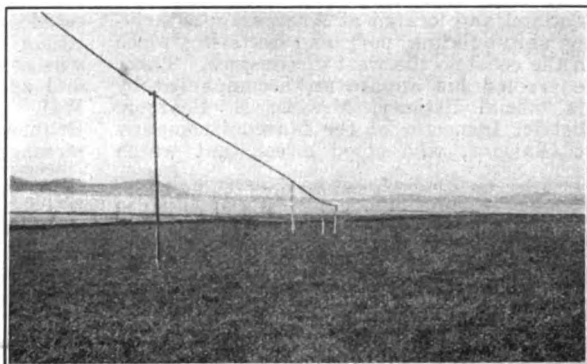
The spark stations heard by Mr. Godley are Canadian 3BP, Newmarket, Ont.; 1ARY, Burlington, Vt.; 1AAW, not yet located; 1BDT, Atlantic, Mass.; 2BK and 2DN at Yonkers, N. Y.; 3FB, Atlantic City, N. J.; 9ZJ, Indianapolis; and 8BU of Cleveland. The C.W. stations reported by him are 1RU, West Hartford; 1RZ, Ridgefield, Conn.; 1ARY, Burlington, Vt.; 1BCG, Greenwich, Conn.; 1BDT, Atlantic, Mass.; 1BGF, Hartford; 1BKA, Glenbrook, Conn.; 1XM, Cambridge; 1YK, Worcester; 2EL, Freeport, N. Y. (spark or C.W.?); 2EH, Riverhead, L. I.; 2FD, New York City; 2FP, Brooklyn; 2ARY, Brooklyn; 2AJW, Babylon, L. I.; 2BML, Riverhead, L. I.; 3DH, Princeton, N. J.; 8ACF, Washington, Pa.; and 8XV, Pittsburgh.

Mr. Godley also brings back the rumor that on Dec. 9th British amateurs in London heard a phone signing WQM play the "Humoresque" at 10:45 p.m. G.M.T., and at 10:55 a piano solo, the wave length was 200 meters. WQM is listed as the broadcasting station of the Wichita Electric Light & Power Co., Wichita, Kansas, but at this writing they have made no response to our attempts at verification.

1BCG is reported from Holland and Germany during the tests, and we are informed that 2ZL was also heard in France. Some DX!

1AAW was originally reported as 1AAY, thru a mix-up in the separate code used between Messrs. Godley and Coursey, and was later corrected by cable to us. When the report of the first night came thru, advising that 1AAY had been heard, excitement reigned supreme at Hartford headquarters. Shown by our call-book to be in Bridgeport, Conn., he could not be located by telephone nor could any other Bridgeport amateurs. So we got E. H. Armstrong, from 1BCG, to drive there in an effort to locate him, which Mr. Armstrong did in the wee sma' hours of that same morning, only to find that 1AAY had moved to New Jersey. Radio Inspector Kolster was routed out and advised us that the call had been reassigned to Fitchburg, Mass. Later that day the Chief of Police of Fitchburg, whose name incidentally also is Godley and whose people are from New Jersey (wonder if he's red-headed?), located the Fitchburg lad and got him on the telephone wire for us, but he had only a quarter-inch coil and no aerial. With what fear and trembling he must have answered the summons to report to the

Chief of Police! Then the correction came from Godley and we were off again, this time after Roxbury, Mass., with Mr. Entwistle doing the Sherlock act. Meanwhile former 1AAW from Bridgeport comes in with the dope that he has moved to Belleville, N. J., where, altho it is the Second District, he operated on that test night with four amps in the aerial and signed 1AAY. But in view of Mr. Godley's correction he was very QRZ hr. And



The "Beverage Wire," pointing out to sea across a low island.

1AAW in Roxbury hadn't operated a transmitter for six months! We thought we were up a tree at first but 1AAW and numerous Boston amateurs advise that the call *has been heard* on the air around there and that somebody else has appropriated the call. Whoever the would-be 1AAW is, he is sticking tight under cover now, as he knows he is a law-breaker, and to date he has not been located. It is a pity, too, for if he were within the law he could claim the honor of being the first station heard overseas in the tests.

1BCG seems an easy winner as the star station. In addition to being heard all over the map they got thru a coherent message on broadcast, at 3 a.m. G.M.T. on Dec. 12th, which was acknowledged by Godley by cable to this office. The first amateur transatlantic message ever sent read as follows:

*"Nr 1 NY ck 12 to Paul Godley, Ardrossan, Scotland. Heartly congratulations. Burghard Inman Grinan Armstrong Amy Cronkhite."*

Speaking of results of the tests, another result was that we won a perfectly nice spring hat from W. W. Burnham, of London, who took us up on our editorial bet before referred to, that a good U. S. ham could get signals over there. When the tests were over Burnham wired us:

*"Congratulations Cable size of hat"*

and we expect soon to publish a picture of our editorial self in the new London Lid.

Many prizes were offered by British firms to the successful receivers over there, and Messrs. Burnham & Co. have offered one of their Ultra III receivers to the most successful American contestant, the award of which has not yet been determined.

### The Test Nights

It was wonderful to sit in on the tests. Goodness knows how many transcontinental records were broken, for an amateur never misses the opportunity to listen for fellows on the other side of the country when he knows they are sending on schedule. During the free-for-alls one could hear district after district start up, as regular as clock-work. First the air would be full of 2's, then it would change to 3's, and as the last 3-station shut down he would wind up with a "Go ahead, 4's, give her juice!"

Those were wild nights in Hartford. A little group of us were on the job every night at the Traffic Manager's static-room, waiting on a long-wave set for MUU to send the nightly report. The air was so thick with tobacco smoke that it was hard to see how a signal could get into the room, but WII with his tape transmitter could be heard tearing along in the background, and regularly at 2 o'clock he would slow down and say "Give me Godley's message". And then with what tenseness, with what wobbly hands and stifled breathing we listened as MUU started his hand-sent report! Here she comes, fellows! Will there be call-letters? Who has been heard? That was the absorbing question! Later in the tests we got so that we knew that a check of 17 or some such small number probably meant nothing but a report of weather conditions but you should have seen us when the big message came thru with a check of 94. Oh, Boy, that meant *signals*! And there were eighteen of 'em! And of course the same scene was being enacted in countless radio shacks all over the country.

About 2:05 the telephone line would be getting hot and what with press reports, telegrams to file, countless long-distance calls from everywhere, there was no use going to bed. The newspapers are wild for radio dope these days and our A.R.R.L. got lots of publicity and Amateur Radio a big boost up the ladder from these tests.

### In Appreciation

Paul Godley returned to America on the "Olympic" on Dec. 28th, a conquering hero! He was met at the pier by many of those who saw him off and an informal luncheon was given in his honor at the Hotel Pennsylvania. The faith that his friends put in him had been more than justified. His niche in the Radio Hall of Fame is secure forever. With deepest gratitude we acknowledge our binding indebtedness to Mr. Godley, for the personal sacrifices he made to act as the representative of American amateurs overseas; for the suffering

he went thru in their name; for the wonderfully successful job he did in spite of difficulties. And our congratulations, Paul—long may you radiate!

Our deep thanks are also due to Mr. Coursey for the admirable way in which he organized the British end; to Mr. Coursey and numerous British radio men for the courtesies shown Mr. Godley; to the British listeners, one and all, for the interest that made the tests possible; to our own Secretaries of State and Commerce for their kind co-operation in getting Mr. Godley thru the miles of red tape; to the British post-office authorities for the permits so graciously granted; to the commercial companies on both sides of the water, Radio Corporation men in general, and in particular to Traffic Manager W. A. Winterbottom of the Radiocorp and Mr. Henry W. Allen, joint general manager of Marconi's, Ltd., for the co-operation that made the special MUU and WII broadcasting arrangements possible; and to Canadian and American amateurs themselves for their good sporting spirit—and our congratulations to the successful ones! All share in writing a glorious page in the history of Amateur Radio.

### The Future

It is with much trepidity that we venture to talk of the future. Who can say? But surely these accomplishments open the road to broader field of Citizen Radio. The scientific world is startled at our A.R.R.L.'s achievement. In the most graphic way we have demonstrated the high radiation efficiency of the short waves. To put a message across the Atlantic on less than one kilowatt! *It was done.* To cross the Atlantic on antenna powers of fifty watts or less! *It was done.* To get over on wave lengths sometimes under 200 meters, with our aerials that are as grasshoppers to the commercial stations! *That too was done.*

Some of the stations had remarkably low power. But they used C.W. and one of the greatest lessons to be learned from these tests is how very much better C.W. is than spark.

We sincerely hope that as a result of these tests amateurs not only in Britain but on the Continent as well will be inspired with the ambition to get into the relay game and duplicate our feat in the reverse direction, giving us the opportunity to repay our debt to them; that, being shown possible, one-way amateur traffic to England and other countries may begin soon on schedule; and that the British authorities in particular will be so impressed by the potentialities of such work as demonstrated by our tests that the amateur restrictions in that country may soon be sufficiently modified to give hope of successful two-way amateur communication across the Atlantic.

That will be the fun, eh, fellows—to sit



at the old set on a cold winter's night, the bulbs burning cosily in front while the generator purrs sweetly in the corner, the old cob pipes neatly filled in advance and set in a row for a hard night's work—and then clear England, Scotland, France, and Holland in turn! (No, we never take a

drop of stuff like that, and we really believe that such things some day will come to pass.)

Surely radio has been given added impetus by these tests, and certainly the day of International Private Radio has been brought closer!

## Official Report on the Second Transatlantic Tests

By Paul F. Godley

**M**ENTAL processes during great moments are extremely complex and I shall never be able to fully recount those of mine, either upon the memorable occasion when, amidst the inspiring farewells of a host of renowned amateurs, the "Aquitania" bore me towards an unknown professional fate, or those of that other and greater moment, when without regard for the atrocities of the Scottish night the first American amateur signal finished its 3,500 mile journey at Ardrossan.

On the first occasion I was overwhelmed with a wish that some fairy power might sweep twenty thousand "hams" to a place beside me, while on the second it was with the utmost difficulty that I restrained a joy which cried for the slam of a switch, the mad whine of a motor, and the crazy stuttering of a key. No sinking tramp at sea ever bewailed its lack more than I bewailed it then.

The "Aquitania's" sailing marked the beginning of a short respite from a physical strain under which work, plan and preparation had placed me. No one else will ever know how much I needed sleep, and I began taking it in large doses. On the other hand, the first signal brought with it welcome and almost complete mental relief, for five nights of listening to static and high power station harmonics near London had left me in a somewhat dubious frame of mind, which may be judged from the fact that all thoughts of sight-seeing were dropped forthwith—a trip to Paris which had been planned was given up, and I began to muster meteorological "dope" from every quarter.

The first signal also ushered in a new period of physical strain, for it was found necessary to set up equipment under an indifferent tent, in an open field near the beach, and the test period was attended throughout by high, gusty, changing winds, heavy downpours, and a chill damp which drew heavily on one's reserve energies. So far as I know, for an American, there

is but one comfortable place in winter in all the British Isles. That place is in bed—with a hot water bottle at your feet. Hospitality, of which I found a plenty everywhere, will warm the cockles of your heart, but it's no good for the joints, so those whose hospitality I sampled secretly complained of gas bills.

It seems to me now that the most remarkable phase of the entire undertaking lay not so much in its complete success but rather in the thoroughly whole-hearted co-operation encountered at every step—both during the formation of plans and during their execution—and before following through this narrative every American relay man will be glad to recognize a debt of gratitude towards all those men and those organizations who seemed to find *pleasure* in doing *anything* to insure success.

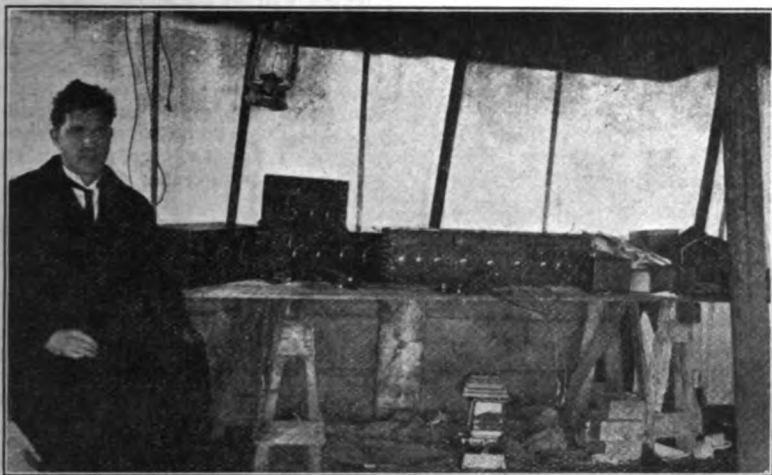
It was generally known that various American manufacturers had lent their full support to the project. Sensitive, rugged Baldwin 'phones did their excellent bit. None in England could equal their ruggedness, and none were more sensitive. The small precision wave-meter of the General Radio Company checked to a hair on 200 meters with the unusually fine standard owned by Mr. Frank Phillips, of Wembley Park, London. Burgess batteries took to the wet and muck without a whimper. The A. P. amplifier tubes I had used in tests on this side were still intact and carried on throughout the whole procedure. The Radio Corporation's U.V.200 detectors functioned as gas content tubes in a way which was surprising to British amateurs who saw them working, while the Paragon Super-heterodyne and regenerative receivers pulled in signals in a manner which astounded everyone including Inspector D. E. Pearson, of the Marconi Marine Communication Company, Ltd., who was checking operator throughout the test.

During formation of plans, encouragement was offered by a full score of prominent radio engineers, and everyone was

delighted with the generous attitude displayed by W. A. Winterbottom, Traffic Manager, Radio Corporation of America, whose efforts made possible the daily reports via Carnavon and New Brunswick—reports which passed as paid messages but which were never paid for, because Mr. Otto Rochs, Marconi's (England) able traffic manager, informed me there had been no intention of accepting payment. Messrs. Allen and Bradfield, Marconi's joint general managers, took a fatherly interest in the whole program. No amateur could wish for better friends, and tho very busy men they found time to be lavish with suggestion, assistance and real hospitality. Their assistance took the form of men and

In England Mr. P. R. Coursey, editor of "Wireless World," and his associates labored cheerfully to properly organize England, and Commander Frank Phillips opened his home and placed his very complete station at my disposal, while all manufacturers did their share toward boosting the interest in the tests in England by offering prizes.

I wish also to express my thanks for the assistance unwittingly given by one Mr. Louis Falconi, station 5ZA, of Roswell, New Mexico. It will probably be a great surprise to him when he learns that covering a period of about one week prior to my sailing, during which time the apparatus which I was to use was under test,



Inside the tent at Ardrossan—Mr. Pearson, checking operator.

materials at Glasgow, and the services of Mr. Pearson at Ardrossan. Capt. H. J. Round, of the same company, and whose valued contributions to the art are quite familiar to all American amateurs was also greatly interested in it all and offered anything he had in the way of equipment, such as a 22-stage amplifier, and proved an exceptionally fine host during my visit to the Chelmsford works of Marconi Co.

Of course, amateurs both in America and England were always ready with assistance. We dared to expect that, but certain amateur services stand out a bit from the rest. On this side it seems to me considerable credit should go to E. H. Armstrong for the keen interest he displayed prior to the tests, and the amount of time and energy which he expended in an effort to insure the success of this great undertaking. I feel that I should also call attention to the generosity displayed by the Adams-Morgan Company in releasing the writer's services for this work at a season, when, as all radio manufacturers know, every effort counts.

I used his very uniform signals to check and recheck the operation of the equipment. I not only received his signals during this period on the regenerative receiver, using the detector and two-stage amplifier, but also was able to get him nicely on a nine-turn loop in conjunction with a super-heterodyne receiver, when his signals were of such strength and regularity as to enable the operation of a four-ohm sounder by the insertion of relays in the circuit. The results of this reception greatly surprised several members of the Radio Association of Northern New Jersey, who chanced to visit my home very early one morning.

A thing which stands out in great prominence is this: the American amateur has given his British cousin a surprise. I am quite certain there wasn't an amateur in all Britain who thought it could be done. I can well imagine the glad surprise which must have spread out from London, when it became known that signals *were* being received. British men came in on it too, and as a result of all these signals from

America, there is a good deal of speculation in Britain at this moment on the endless possibilities of amateur radio on short waves. Whereas in the past they have been thinking in terms of 1,000 meters, they are now thinking in terms of 180 meters. They are limited to ten watts input, and their antennas must have no more than 160 feet of wire total.

Wasteful coils are necessary to load such a small antenna to 1,000 meters. Also, waves of this length do not travel at night like the shorter ones. Many will listen for us on 200 meters, and I hope soon we may be receiving them on 180. Good engineering on their part and a bit of luck will make it possible even with ten watts.

Good fortune seems to have followed everywhere. To begin with, there was that very impressive dinner the night preceeding my departure, and the farewell party at the dock. An account of these doings has already been printed, but a part which was not staged was that I should meet on the deck of the "Aquitania" as she left New York Harbor, one H. H. Beverage, receiving engineer of the Radio Corporation of America, and by the way one who qualifies as being a "hard boiled ham." Needless to say, I had not been with Beverage long before we got around to that thing which is nearest his heart, to wit, the Beverage wire, as a static reducer.

Now, to those of you who are uninitiated an explanation of this term "Beverage Wire" will be necessary and it will be forthcoming later. The point I want to bring out here is that the thought of this Beverage wire served as a great buoy during the period previously mentioned when, after listening five consecutive nights near London, I had heard nothing but static and harmonics.

Before the "Aquitania" had been away many hours the great interest displayed in the undertaking began to be manifested by the radiograms sent by many amateur and professional radio men. The first of these came in over the signature of J. Andrew White, editor of "Wireless Age" and read:

*Just an added slap on the back old man to emphasize my sincerest wish that this trip of yours will go down in radio history.*

This was followed by several others among which was a greatly appreciated one from my old friend Harry Sadenwater, who, it will be remembered, served as radio officer on the ill-fated NC-3 during the transatlantic seaplane flights. He heartily wished me a "bon voyage and wonderful success."

Late in the evening of the first day I learned that Mr. H. M. Short, Superintendent, Marconi Int'l. Marine Communication Co., Ltd., had requested the Aquitania's

radio men to extend all courtesy to me and they proceeded to do all possible in making me feel at home, with the result that twenty-four hours later I found myself taking the following from WBF:

*From Hartford, Conn.  
To Paul F. Godley, SS Aquitania via WBF.  
Bon Voyage! The entire radio world is pulling for you!*

*(Signed) Warmaxnell*

while on the fourth day (Saturday) the High School Radio Club of Montclair, N. J. passed out a "73" via VCE (Cape Race).

Contrary to what may have been the general idea of this trip, at no time had I viewed it as anything even remotely resembling a lark, for there were sacrifices which had to be made. But, it was these radiograms—each bubbling over with sincerity and a will for success which first brought home to me the extent to which all these eyes reddened by long watches on the relay routes must be following me. As I tossed about in bed during the wee hours of Sunday morning the 19th of November I took note, too, of the veiled interest which had been shown in engineering circles, and before dropping away to sleep I remember mentally repeating over and over the resolve to *get signals or bust!*

The voyage was not rough—neither was it particularly smooth. Fortunately the state of the sea concerned me not at all. A good portion of my time was spent with the three very likable men in the radio cabin, Messrs. Maundesley, Farnam and Porter, respectively Chief, 2nd and 3d operators. It was impossible to do any real listening on amateur waves however. The vast quantities of radio traffic and book work which is to be found on the ocean greyhounds make this impossible, and I had, for the most part, to imagine the "bon voyages" and "73s" and "good luck" messages which were being passed out on short wave lengths, and I understand there were many of them.

As we neared the French coast I filed a message to a staunch League member, Mr. Leon Deloy, of Nice, France, extending greeting on behalf of his American contemporaries to which he promptly replied: "Radio greatly appreciated wish you complete success would be delighted to meet you".

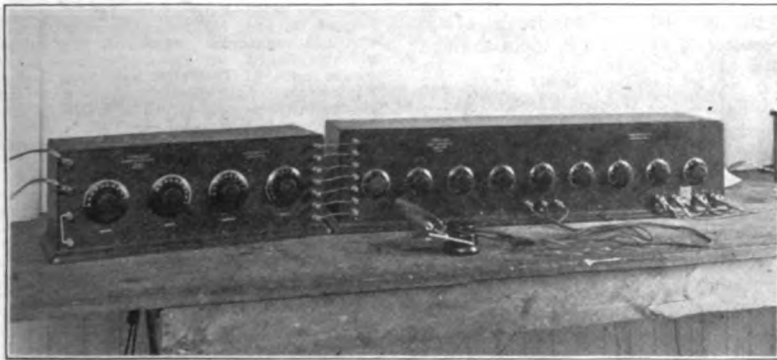
I was very much surprised upon reaching the dock in Southampton to find Mr. H. J. Tattersall, Superintendent of the Marconi Company in Southampton, waiting to help me through the customs, and I was indeed glad to have him. It happens that a very heavy duty had just been placed on all radio equipment. Under these circumstances, British custom officials were inclined towards placing all of my apparatus in the warehouse in order that within the next two to four weeks some customs

officer might go over it at his leisure, place a proper valuation upon it, and exact duty accordingly. After considerable running around to various officials, and after a great deal of pleading with the Chief Customs officer of that port, we were told that if I cared to leave \$100 with the customs people, they would pass the equipment through, the \$100 to be returned at that time when the equipment was again taken from the country.

And so I finally reached London on a funny little train, and began to meet the various notables in and around London. I consider it of extreme fortune that it was possible for me to attend a meeting of the Wireless Society of London, and latter to hear an extremely interesting lecture by

met Marconi. He showed a flattering interest in a recital of the events which had led up to my visit and in amateur accomplishments in the States. He expressed every hope and seemed to feel confident that the tests would prove successful, and as I left him he asked me to pass on to American amateurs his good wishes, for, he said: "I, too, am but an amateur!"

As we passed out of the old building which had housed the Royal Society of Arts for many decades, I again felt myself being steered, and again we approached a long table in the balcony of a gaily colored restaurant. This, apparently, was to be a little dinner party in my honor, and so it proved—and it was a merry, long-to-be-remembered time we had while I managed



The tuner and amplifier which made up the Super-Heterodyne used at Ardrossan. As connected for use with Beverage antenna, the special regenerator shown on page 25 was inserted between this tuner and the antenna.

Dr. Fleming at a meeting of the Royal Society of Arts, and to meet and chat with such men as Senatore Marconi; Admiral Sir Henry Jackson, president-elect of the Wireless Society of London; Mr. Campbell-Swinton, past president of the society; Prof. E. W. O. Howe; Mr. E. K. Shaughnessy of the Wireless Section of the G. P. O.; Mr. F. Hope-Jones, Chairman of the Wireless Society of London, and many others.

Just prior to the meeting of the Wireless Society I was led into a large room adjoining the lecture hall and to my surprise found a long table heavily laden with various attractive things to eat and behind which several young ladies were wielding the tea things. It was time for a regular meal, so my stomach said, but it didn't quite look like a regular meal. However, after being assured that it was safe to do so I managed to personally superintend the rapid movement of a considerable portion of the commissary, notwithstanding that most everyone made great efforts to get me to talk.

At the close of Dr. Fleming's lecture I

to put away another big feed all in the same evening. And would you believe it—there were two "O.W.'s" in the gang! and they, too, joined in the toast to American Amateur Radio and to the success of the Transatlantic tests

As far as I was concerned, British hospitality had never been properly advertised. I had never expected so great an effort to make me feel at home, and while I was thinking this all over I was at the same time noting the glances on every hand which I understood as meaning that these British amateurs had been unable to decide whether I was just a "nut" or whether I was really confident of our ability to put the thing over.

Preliminary arrangements for an operating permit had already been made by Coursey and two days after arriving in London I set up the regenerative receiver and super-heterodyne at the station of Commander Frank Phillips above mentioned. British amateurs are very keen on radio-frequency amplification. Remember, most of their work is done on 1000 meters which



makes it a somewhat simpler matter. Phillips, the designer of the "Burndept III" receiver, thinks very highly of his fine little outfit. Before many hours, however, he agreed that the Paragon regenerative combination gave signals somewhat better than those obtainable on the outfit he was using, and that it was a thing not to be lightly passed by.

The vast numbers of harmonics from single circuit tube transmitters and Poulsen arcs, which one picked up at all times, struck me forcibly. Atmospheric conditions, too, were of an unusual type. I have never before encountered anything like it. During the winter time here in America we expect atmospherics will be negligible, or, if present at all, quite uniform in their habits. At Wembley Park I found them suddenly increasing during certain short periods of the night, and suddenly decreasing to appear again in another quarter, and in a new form.

Later, we got the Super-Heterodyne going, and it was quite apparent that all who saw it in operation were greatly impressed. Cmdr. Phillips showed particular delight when we picked up a 10-watt radio phone station at a distance of 18 miles on a coil having 8 or 10 turns and a diameter of 3 inches. We revolved the coil about on a pivot, and in this manner got the direction of the transmitting station. During our work with the super-heterodyne, I decided to make alterations in the mechanics of the capacitive feed-back. Accordingly, I put a bushing through the panel, placed a shaft in the bushing with a spring washer



to hold it firm, and so arranged this shaft that it controlled the small condenser. During the initial test of this little device the amplifier began to squeal vigorously. Phillips immediately jumped up from his chair and rushed to another room, to appear a few minutes later with an oil can from his wife's sewing machine, whereupon he proceeded to oil this shaft in its bearing. He maintains that there is no connection between the squeal of the amplifier

and the idea which he got that oil was needed, and it may be that he is right; nevertheless, it is too good to keep.

London newspapers began to show a considerable interest in the tests very shortly after my arrival, and I was greatly amused to find the following printed on the editorial page of the "London Star" on November 30th:

#### THE FAR CALL

Prospects of the New Trans-Atlantic Wireless Test.  
By "Nautacore."

"On December 8 there begins a series of Transatlantic wireless tests similar to those which took place last February. As then, American amateurs, using small power and short wave-lengths, will try to get into communication with this country. 'The stations taking part are purely "amateur" but must be proved capable of bridging at least 1,000 miles in the States or Canada. With an amateur's small power, and short and theoretically inefficient wave-length, 1,000 miles is a big achievement; yet it has been done. In theory, a station can do little without a fair amount of power behind it, but, in fact, American stations, with a nominal maximum range of 250 miles, are often plainly heard in this country, whilst Valentia (west coast of Ireland) has kept up a brisk correspondence with British ships entering New York Harbour, although the official lists state that she cannot exceed 600 miles.

"Last February's tests were unsatisfactory from the point of view on both sides. In the States too many persons "tried their hands." On this side, the delicate, finely-tuned instruments employed were interfered with by wireless novices using receivers which acted as miniature transmitters—drowning the feeble pulsations of American aeriols. Americans, however, reject that excuse for our non-reception, declaring that incompetence had a lot to do with it; and to make certain of really good reception this time they are sending over one of their hardest of "hard-boiled ham" with a brand-new bag o'tricks and their good wishes. He will show us how it should be done.

"The wireless magazines have made their last appeal to those not taking part in the contest to "earth" their aeriols and go out for a walk during the specified hours and nights, so that interference may be reduced to a minimum. Those who have entered their names will conscientiously avoid "regeneration." Will all respect to the "hard-boiled ham" I invite him to do likewise—avoid "regeneration." Then we all might get something."

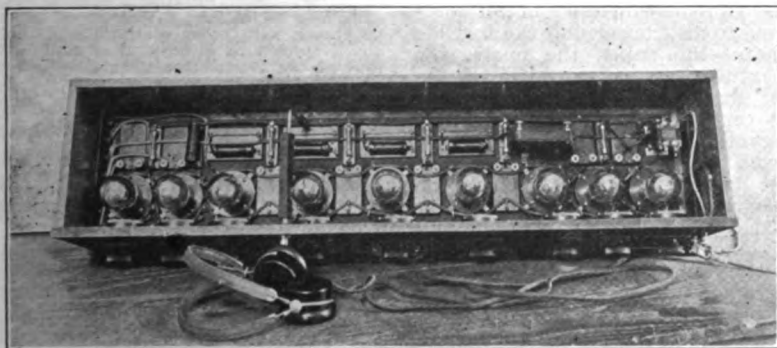
(And now you know why I went to Scotland!!)

I was most anxious during all this period to gather what information I could concerning the handicaps under which British amateurs were working. The situation is something like this. Prior to the war British amateurs were allowed wave lengths of 180 meters and were limited to an input of but ten watts, licenses to use transmitters being granted only in a few cases. Subsequent to the war, due to some processes in the British Post Office which I was unable to analyze, British amateurs were given a choice between an operating wave length of 180 and 1,000 meters. There was a time during pre-war days when we ourselves no doubt would have welcomed operation on 1,000 meters, and it is I presume only natural that British amateurs availed themselves of this opportunity to choose the longer of the two. In view

of what we have learned concerning the efficiency of antennas, and in view of the fact that the total length of wire in their antennas must be less than 160 feet, however, it is quite apparent that any transmitters operated by amateurs on a wave length of 1,000 meters would be operating at a very low efficiency. Further, our experience with short wave transmission has taught us that we may expect phenomenal distances under night-time conditions, particularly during the winter.

I believe that as the result of these tests, and as the result of some discussion during my visit to England concerning the relative merits of the two wave lengths, British amateurs are now studying the

time I suggested to him that amateurs could cause very little disturbance, even if given the greatest of freedom, provided they were kept to 180 meters. His reply was to the effect that the shorter the wave length the greater the number of stations there were which could be operated within a narrow band, at the same time overlooking the fact, apparently, that all waves below 275 meters are at present almost completely blanketed by harmonics from various high power spark, arc, and tube transmitters; and, in this connection, I was highly amused a day or so later to be able to count up to the 39th harmonic radiated by a G. P. O. station which is located in the north of Scotland. This station is trans-



Interior arrangement of amplifier cabinet of Super-Heterodyne used at Ardrossan.

possibilities in connection with transmission on 180 meters, and in fact men repeatedly asked me for such pointers as it was possible for me to give them regarding transmission on short waves.

As mentioned previously, I met Mr. E. H. Shaughnessy, chief engineer, wireless section, G. P. O., and got, in an offhand manner, some of his views concerning amateurs and amateur work. Briefly, I should say that if Mr. Shaughnessy's attitude is representative of that of the G. P. O., British amateurs have a hilly road ahead of them. Mr. Shaughnessy showed great interest in amateur development in America—in fact, he seemed greatly surprised by the rapid strides which have been made in connection with radio-phone broadcasting since the war; but expressed the opinion that whereas American amateurs were so fortunate as to be situated on a large continent, set apart by itself, British amateurs found themselves on a small island, close to many foreign lands, with the result that no liberties could be given them without first considering what effect these liberties might have on various international radio communication problems. At this

mitting a great portion of every day.

It is most reasonable to assume that British as well as American men are able, eventually to get that thing which they go after, and there is no doubt in my mind that British amateurs are going after a more liberal G. P. O. policy. Neither can I believe that the British public can long remain blind to the almost limitless possibilities and advantages to be derived from a liberal radio-phone broadcasting program. I wonder if even here in America we amateurs realize that today the state of the art makes it possible for the President of these United States to speak directly to every citizen in the land? One's imagination cannot help but see the immense value of such an arrangement during times of national peril.

During the entire first week in London everything was blanketed with heavy fog. On one morning in particular upon coming from the "Underground" onto the Strand, the fog and smoke was so thick that it was impossible to see more than twenty feet ahead. Accidents of all sorts were occurring in the streets, and finally traffic had to be entirely abandoned, not withstanding

the fact that at all main street intersections huge flares were going continuously. At this time the fumes in the atmosphere were so violent as to make one cough continually, and the tears run down one's cheek.

Five nights of this sort of thing were quite enough. I was not at all at home under circumstances such as these, and since I could get no assurances from anyone that these conditions were not to continue indefinitely, I came to the fixed conclusion that the vicinity of London—even southern England for that matter—was no place for me, and arranged accordingly to proceed to Scotland, having previously chosen Ardrossan as the location providing conditions near London did not warrant remaining there.

Immediately my decision to change locations became known, wild tales of all sorts began to come to me, concerning the terrible Scotch climate—the rains, the mists, the chill temperatures, to say nothing of the ill effects of the Scotch whisky which one would most certainly be unable to dodge. Even taking all of this with a good grain of salt, I was not sure that I looked forward to the trip into the "Scotch wilds" with any particular pleasure, particularly in view of the fact that even after having been in England a week, I cannot remember at this time of having found a sufficiently warm spot.

The first problem which presented itself subsequent to this decision was the necessity for procuring an extension of the operating permit, or in lieu of that, a new permit which would allow the operation at Ardrossan. Messrs. Coursey, et al., were not at all enthusiastic concerning the possibilities of such extension within the few hours available, and were unable to see by what process such an extension could be pried out of the G.P.O. Several efforts were made to put me in touch with Capt. D. Loring of the G.P.O., and they failed, and finally deciding that we must have action, I myself went to the General Post Office Building, and by good fortune obtained an interview with Mr. J. W. Wissenden, Assistant Secretary, who proved to be a very good listener and a very amiable gentleman, but who was unable for some little time to see just how he could comply with my request. After an interview lasting about thirty minutes, he proved himself to be a thoroughly good fellow, and assured me that the required permit would reach Glasgow the first of the following week—in time to enable me to institute the program as scheduled. I remember telling him, after he had announced his decision, something to the effect that "I could expect no more from my own father", and I still feel that way about it. I do not know what sort of magic wand Mr. Wissenden waves, but I do feel sure

that he is apt to prove a real friend to British amateurs in the not too distant future. Coursey and the other men in his office at the time seemed greatly surprised to find me back so quickly with the good word, and someone remarked something to the effect that it must be great to be an American. I wonder what he meant?

The permit reached me in good time, via Coursey, and here it is:

184562-21

GENERAL POST OFFICE,  
LONDON, E. C. 1.  
2 December, 1921.

Mr. C. F. Phillips is hereby authorized to install and use for receiving wireless signals for experimental purposes during the month of December, 1921, at a station within 40 miles on land of Glasgow (but not within 1 mile of any Government Wireless Telegraph Station), apparatus for that purpose (including valves), and any aerial which may be considered necessary for the experiments. Mr. P. F. Godley may use the apparatus as the agent of Mr. C. F. Phillips.

It is necessary to stipulate that the apparatus shall be used in such a manner as to cause no interference with other stations, and that this permit is subject to withdrawal or modification at any time at the Postmaster General's discretion should occasion arise.

(signed) J. W. Wissenden  
for the secretary.

About the time I was ready to shift for Scotland it began to look, as the result of cablegrams received from members of a committee of the Radio Club of America, which had been appointed to investigate the reported reception of station 2QR in Scotland, that it would be desirable for someone to go to Aberdeen, make the acquaintance of Messrs. Miller and Benzee, and learn what he could concerning this reception. Final conclusions reached partly as a result of this trip have already been reported, and I greatly admire the sportsmanlike spirit shown both by Messrs. Miller and Benzee, and by the Messrs. Robinson on this side. The tendency on the part of British amateurs near London is to believe that the gentlemen in Scotland had heard a *British* amateur phone, and this would seem quite likely.

The Miller brothers were located in Aberdeen at their attractive little general store where they carry a full line of handy electrical appliances, clocks, watches, etc. They had dismantled their original station, but had in operation sufficient paraphernalia to enable their getting time signals. And, after a long drive by motor into the country I found Mr. Benzee at work in his radio shack beneath two very fine looking 80-foot masts. He had the best looking amateur antenna which I saw in either England or Scotland, and as I entered his station and had a look around I wished it were possible to place in front of him some of the fine equipment which is available to American amateurs, for he seemed to be doing exceptionally good work with a great deal of ingeniously gotten up but clumsy and, I fear, rather inefficient home brewed "gear". He was greatly interested

in everything we fellows over here are doing. He had the bug badly, and would come nearer to feeling at home were he to be suddenly dropped into the thick of amateur activities on this side than any other whom I met.

On Saturday evening Dec. 3d I arrived in Glasgow from Aberdeen and got quickly into bed at the Central Station Hotel. I had been nursing a cold, and was very desirous of resting up a bit, and shaking as much of it as possible.

On Sunday, December 4th, I came out to find the temperature about 30 degrees, and a very chillingly heavy fog. My log book reads as follows:

"Slept until noon in an effort to get warm. After mid-day meal, went out to look over Glasgow, but so chilled, gave it up after two hours. Returned to the hotel and hugged open grate fire in lounge, wrote a letter, had dinner, and went to bed to keep warm. No heat in hotel rooms. All shops in Glasgow closed tight on Sunday. During evening, also made schedules for following day, since tests began in 60 hours. To properly locate and make all necessary preparations calls for some hustling."

"Monday, December 5th, Central Station Hotel, Glasgow. Weather, 34 degrees and overcast. No fog. Present letter of introduction from Mr. Allen of Marconi house to Mr. J. A. Carswell of McNaughton Bros., Ltd., and found him busy, interested and agreeable. He sends his secretary with me to meet Mr. D. Sutherland, superintendent, Marconi International Marine Communication Company, Ltd., to whom I also have letter of introduction from Mr. Allen. Mr. Sutherland takes me in tow and I get tent, wire, insulators, accumulators, etc., etc., in very short order. Carswell, Sutherland and self lunch together. Very enjoyable. Leave Glasgow 4 P.M., Caledonia Railway for Ardrossan, arriving 5:30 P.M. (Eglinton Arms Hotel). Get large scale maps of Ardrossan, and try to choose likely site. A walk out in dark after tea shows all beach sites unsuitable account tides. Getting local color from Mr. Lee, proprietor of Eglinton, until 1 A.M. Weather warmer and clear spots in sky when I turn in."

Mr. Sutherland was not particularly struck with the chances of my being able to secure the necessary materials and get them to Ardrossan within the time limits which I set. In fact, it took him about 20 to 30 minutes to get used to the idea, when suddenly he seemed to take great interest in the thing, and began to make the dirt fly. I was greatly pleased a few days later when he called me on the 'phone. The opening of the conversation ran something like this: "'Ello, 'ello, who are you? I say, Gadley, I want to congratulate you. I didn't think you would do it." (Meaning getting my equipment into operation

in so short a time.) Neither Mr. Sutherland's nor Mr. Carswell's interest stopped here, and they took advantage of every opportunity to get me on the telephone, to send mail and packages down by messenger, etc., etc., and they expressed a genuine delight when the good news reached them to the effect that our tests were successful.

I soon found myself with Mr. Wood, the town clerk of Ardrossan, and police officials, as well as several other worthy citizens enlisted in my cause. The day in Glasgow had been a foggy one, and I began to wonder whether or not my trip to Scotland was to be proved useless. At Ardrossan, however, the fog had cleared and was replaced by rain in great abundance. High, gusty winds were blowing, and although the tendency upon arrival was to sit tightly by the fire at the hotel, and bundle myself up, I went forth into the night in an effort to get the lay of the land. There remained but 30 hours before the tests commenced, and I was extremely anxious to locate that bit of ground upon which I might decide to erect the Beverage wire. The exploration of the night included a patrol of the beach south of Ardrossan, as well as the beach north of Ardrossan, both of which places on the map showed promise of being suitable for the purpose. I was very much downcast to return after three hours in this weather and after having found that both beaches were almost completely covered with water at high tide. The following morning further exploration was made, and at nine o'clock I met Mr. Carswell from Glasgow in the office of Mr. Wood, and the three of us proceeded to tramp around in an effort to locate a suitable site. The north beach was once more explored, and then at this point we were caught in an unusually heavy downpour and soaked to the skin, but not until I had finally decided that a certain field upon which we had had our eye would be suitable for the set-up. At this juncture we were invited into the home of Mr. Charles Murchie, and offered chairs beside a warm fire. I still shudder when I think of the awful thing we did to Mr. Murchie's rugs and polished hardwood floor.

We also used the telephone, got a Ford automobile, after some delay, and went off up into the country to locate the owner of the particular piece of farm land which I had chosen. I had been congratulating myself all along on the good fortune of having two interpreters with me, because I must admit I found considerable difficulty in understanding English as spoken in Scotland. When we finally reached the home of Mr. Hugh Hunter I greatly regretted my inability to talk the "brogue", because I was very grateful to Mr. Hunter for the great interest displayed by him in our project, which resulted in his allowing us to use the field.

At noon, Pearson, above-mentioned, came on the scene, and we immediately began transferring huge bundles of tent, storage batteries, trunks, floor boards, poles for the antenna, etc., etc., on to this field. It proved to be a very slippery field. It had been covered almost entirely with a heavy coating of seaweed which is used as fertilizer; and those who have had experience in walking over seaweed know that it is a very difficult matter. The one-horse wagon which we got to haul our paraphernalia on to the field was stalled several times, and it was only by unloading a portion of the equipment and carrying it, and



later by putting our shoulder behind the wagon that we were able to finally reach our destination. The poles were scattered down the field at 125-foot intervals, they having already been drilled to take insulators. Floor boards were spread on the ground, trunks and paraphernalia placed on them, and the tent erected. A laborer began digging holes for the poles, while Pearson, myself and one other man started erection of the tent. The tent had just been gotten nicely into position when an unusual heavy gust of wind lifted the whole affair and carried it away.

My log reads as follows: "Ardrossan, Scotland, December 6th. Weather warm, variable gales, with heavy squalls. Meet Mr. Carswell at office of Mr. Wood, Ardrossan Town Clerk, at 9 A.M., after further reconnoitering. Wood, personal friend of Carswell. We looked over maps, beaches and shoreward fields, and finally choose grass-covered fertilizer-covered field property of Mr. Hunter, about one and a quarter miles north of Caledonian Railway Station. Soaked in rain. See Police Sergeant and present credentials. Police find me a watchman. Arrange for transportation of tent, materials, trunks, etc., and order wire supporters from timber yards. Interview Mr. Hunter, and find him agreeable. Lunch. Inspector-operator Pearson arrived for checking results. Get men and all materials on field at 3 P.M., and attempt to erect 12 x 18 foot tent in gale and rain fails. Make very poor progress. Dark at 4 P.M. Continue work until 6:30. Distribute wire support poles, and lay out line for 1300 foot

wire, supported 12 feet above earth, on a line running approximately 26 degrees north of west (which is directly towards 9ZN). Rain and darkness finally drive us in. Pearson returns Glasgow for clothes, and I rig up small Western-Electric tube on Burgess batteries at hotel, and listen with makeshift regenerative receiver and an emergency 60-foot single wire antenna, and get gas pipe ground. Hear a good many 600-meter stations, and a great deal of heavy static on shorter waves. Small lighting battery expires after two hours and twenty minutes, and this, together with heavy cold and sore muscles, puts me to bed in a greatly depressed frame of mind, inasmuch as I had fully expected to get going full blast tonight. The chill and the whistle of a switch engine beneath my window prevents what should have been a sound sleep."

The following day, having enlisted additional labor, things were going in proper style. A line was laid out something under 1300 feet in length, and ten poles equally separated were erected, each pole being twelve feet above the ground and carrying a standard Post Office pattern insulator. A phosphor-bronze wire was then run the entire length of the line and grounded through a variable non-inductive resistance, the ground plates themselves taking the form of several short lengths of iron piping buried some four feet in the earth, at which depth we found one of the holes filled with water.

My log for December 7th reads as follows: "Weather warm, high winds, and driving rain with occasional slackening. All my clothes wet and heavy cold on chest. Two laborers meet me at hotel at eight (just getting light) and we proceed to the Lynn field. Rain has slackened to a drizzle, but walking on field extremely difficult because of its soggy, and because the field is covered with slimy sea plants. By noon tent is erected, side walls up, and four poles up, the fourth one guyed. Pearson comes on the scene. We plant two more poles, and go to lunch. Darkness finds poles up and wire strung. We continue work in light rain, and bury several ground plates in wet, sandy soil at a depth of four and a half feet. End of line about 200 feet from telephone line (a good stone's throw from beach). Returned to tent, fixed lead-in, and then to hotel for late supper. Procured coffee, sandwiches and a bottle before returning to tent. Made table of boards, and trestles, chairs were boxes and apparatus trunk served as a back rest. A lantern and oil stove were set going, and we made ourselves as comfortable as possible, though small stove did little by way of heating big tent. Tubes, apparatus, high tension battery and storage battery unpacked and found all OK after their long and varied journey through



England and Scotland.

"By 11:30 the 3,000 meter amplifier, which will be used throughout in conjunction with super-heterodyne receiver, was going and "FL" (Paris) was picked up with no antenna connection. In completing set-up his time signals were missed but POZ (Nauen) at 12 midnight served as a check on timepieces. After time signals a 60-foot piece of wire was thrown into a tree for use in adjusting to short waves.

"Picked up many, many 600-meter stations immediately it is connected, and, using them, go through and carefully adjust all apparatus for maximum sensitivity. By about 1 A.M. we were on Beverage wire and feeling for short wave signals, and picking up harmonics from FL's spark and many high power continuous wave stations, although harmonics much less severe than near London, with the exception of Clifden-Ireland's, which are very strong.

"At 1:33 A.M. picked up a 60-cycle synchronous spark at about 270 meters, chewing rag. Adjusted for him, and was able to hear him say "C U L" and sign off what we took to be 1AEP; but atmospherics made sign doubtful! That this was an American ham there was no doubt! I was greatly elated, and felt very confident that we would soon be hearing many others! Chill winds and cold rains, wet clothes, and the discouraging vision of long vigils under most trying circumstances were forgotten amidst the overwhelming joy of the moment—a joy which I was struggling to hold within! I suggested hot coffee at once, and Pearson volunteered to warm it on our stove. He had pot and bottle in his hands when I called sharply to him to resume watch! Our welcome American friend was at it again with a short call for an eighth district station! His signal had doubled in strength, and he was booming through the heavy static and signed off clearly 1AAW, at 1:42 A.M.! Pearson only in time to get the AW on the tail end! We decided at once to leave settings and lay for him. About 1:50 he was in again, but recognizable only by virtue of his tone—totally unreadable!

"Having heard no more of him at 2:35, I returned from a five-minute run down the line to report a pole broken short off, and the line on ground at a point about 700 feet from tent. Winds very high.

"We shut down at 2:35 A.M., and repaired a break in wire, reset pole, and resumed watch at 3:10 A.M. Atmospherics were rising, and although no short wave signals from America, 600-meter signals were booming in with Cape Race readable with telephones on table at times. Closed watch at 6 A.M., after nearly twenty-one hours work of the worst sort.

"Wired Coursey: 'Rains, winds, atmospherics heavy. Working under tent.

Beverage antenna, which fell during night. Heard 1AAW calling eights 1:42 Greenwich, 270 meters, fading, sink gap. Ask him continue same time nightly. Keep all signals coming. Happy."

It might be well here to say something concerning equipment. I do not feel qualified at this time to enter into a technical discussion of the Beverage wire. I decided to use it because atmospherics, in the neighborhood of London, had been so strong as to make the use of the super-heterodyne impossible. The same atmospherics were encountered in Scotland, and although at one time I had intended to erect a fairly respectable vertical wire as a companion to the Beverage wire, thoughts of this were dismissed. For best reception at any given wave length, this wire should have a length equal to one wave length, and according to the dope given me by Beverage, should be grounded at the end toward the station at which the signal originates through a resistance of between 250 and 400 ohms. At the other end the wire is grounded through an inductance having an effective value of about 0.1 milli-henry (for 200 meters). This last inductance is coupled to the receiver, and adjustment of the resistance gives to the wire a decidedly directional characteristic, thus enabling the elimination of a great deal of interference and static. (I now doubt whether or not we ever had this wire properly adjusted for any wave length other than that on which station 1BCG was working, since in order that we might get proper adjustment it was essential that we have some signal to work on.) To make adjustments on this wire it was necessary to run back and forth from one end of the line to the other, and this was rather tedious work. But I have the satisfaction of knowing that we received the signals on the first night that the antenna was in operation, and that we had received a great number of signals prior to the time when British or Dutch amateurs had received any, notwithstanding the fact that according to calculations which Beverage has made, the effective of height of our antenna could not have been more than 65 or 70 feet.

The possibilities of the Beverage antenna in connection with reliable trans-continental and trans-Atlantic relay work are very well worth looking into. At this time I am satisfied that a goodly portion of my success is directly due to the use of this type of antenna. It is hoped that before long complete data concerning it will be available to amateurs.

As to the receiving equipment itself the only apparatus which I carried with me was a Paragon regenerative receiver, together with a Type DA-2 detector-amplifier, and a super-heterodyne receiver, which, including the external beat oscillator, had a total of ten tubes.

The Beverage wire was inductively coupled to the input circuit of No. 1 tube, which was a detector. The plate or output circuit of this tube was tuned regeneratively in order that advantage might be taken of regenerative radio-frequency amplification. The output circuit of this detector tube also included a closed oscillatory circuit, tuned to a frequency of approximately 100,000 cycles. The second tube was used as driver for an oscillatory circuit which, by virtue of its coupling to the input side of the first tube, supplied the detector circuit with oscillations of such a frequency as to produce beats of the order of 100,000 per second with incoming oscillations, this beat frequency being passed to tube No. 3, which is the first tube of the five-stage 100,000-cycle radio-frequency amplifier; all of the stages, excepting the last, are resistance-coupled, while the last is coupled through an air core transformer to a second detector, which in turn feeds one stage of audio-frequency amplification.

The complete circuit for the set-up as used is shown herewith. Inasmuch as various descriptions of this type of equipment have been printed in American magazines, no attempt will be made to go into great detail. Suffice it to say that the coupling resistances have a value of 100,000 ohms; the grid leaks a value of about 2 megohms, the grid condensers a value of about 250 micro-micro-farads. The air core transformer which couples the amplifier to the second detector is tuned to the frequency of amplification. Regeneration at the 100,000-cycle frequency is effected by capacitive back-coupling from the plate of the last radio-frequency amplifier to the grid of one of its predecessors. The cabinets containing the super-heterodyne equipment are lined with sheet copper. All condensers, resistances, leaks and tubes which go to make up this amplifier are selected with great care, and in addition it frequently proves advantageous to shield the cords and cases of the telephone receivers, the shield being connected to the negative terminal of the "A" battery.

For reception of continuous wave signals it will always prove more convenient to set up a tenth tube which drives an oscillatory circuit for this purpose. Usually is better to set this oscillator so that the third or fifth harmonic of the oscillation which it produces falls near the frequency of amplification—this because it is difficult to control the amount of energy fed into the amplifier when the fundamental frequency itself is used for beat production.

On Dec. 8th my log reads as follows: "Weather: High winds and heavy rainfall, changing to clear with northwest winds at midnight. Star-filled heaven and a half moon—a welcome and beautiful sight.

Such a night should be ideal for our purposes.

"Line properly repaired during day and early evening spent trying to get dry at Hotel. Apparatus found in good shape, and constant watch kept until 6 A. M., with no amateur signals heard. Cape Race on 600 meters much weaker than last night. At 4:30 A.M. Pearson goes out and makes a shift in line to ground lead but no signals result.

"Attempt to receive C.W. stations blanketed by high power station harmonics, and the few breathing spells which Clifden takes are welcome ones. If poor weather instead of clear is required for signals it is to be hoped that we have poor weather.

"Clear spell brings greater chill and we shift table a bit and hang canvas to our backs to keep the wind off. A heavy cold which I have been fighting settles further into my lungs. Pearson being a Scotchman seems to be immune, and no doubt would suggest that I don't drink enough of Scotland's Honeydew.

"Wired Coursey: 'Cooler, clear; moderate atmospherics, no signals.' Closed down at 6 A.M., somewhat disappointed, but thankful for yesterday's great encouragement."

December 9th the log reads as follows: "Weather again wet and boisterous and at midnight on cutting in, find atmospherics very heavy, but wind dies away by 2 A.M.; rain continuing to fall, and atmospherics falling off to moderate strength.

"At 12:50, after listening some time for free-for-all sparks, we swing over to C.W. and it is indeed a thrill we get when 1BCG is picked on 230 to 235 meters. A harmonic from Clifden is jamming but after some adjustment this is partially nullified. Signals from 1BCG very steady and reliable. *Remarkable performance* and I wonder what power he is using. Lose him many times in an effort to 'feel out' the Beverage wire, but get him much better after adjustments terminated at 1:33. He is calling 'PF test' and signing. Sweetest song I have ever heard. Calls separated by (?). Changed operators at 1:45 A.M. His sending steady in all cases. He fades out for 30 seconds every 3 or 4 minutes, but always comes back strong and steady.

"At 1:59 A.M. he calls 2BGM and says 'Phone us now', then shuts off. Measures between 230 and 235 meters on little General Radio meter.

"Pearson and I relax, laugh with glee, and start looking for something to eat and drink.

"Continue through night to hunt for more, but without avail. Static fairly bothersome, and Clifden is sending a great deal, and am unable to shake him.

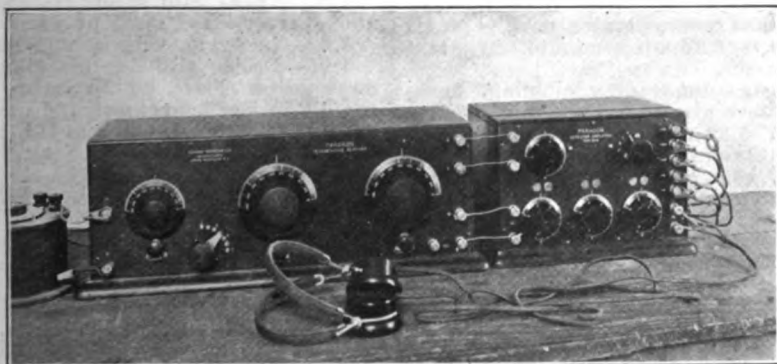
"Shut down 6 A.M. but start up again after talking it over, to copy MUU. MUU sends 'Godley's message'. It comes home

to me that ours is a history making set of tests—that American amateur radio has the world by the ears. I would give a year of my life for a 1-KW tube transmitter, a nice, upstanding aerial and a British Post Office license to operate it on 200 meters. To be forced to listen to a Yankee ham and *only* listen is a hard blow.

"Wired Coursey: 'Burnham owes Warner new hat. Warm rains, calm, decreased atmospherics. 1BCG calling me ending two Greenwich. Undamped two thirty, strong, steady. Congratulations.'"

The performance of 1BCG had filled me with a lot of very wonderful feelings. Pearson and I spent considerable time in talking it over and trying to figure out what his equipment might be. It was hard

kindly mood! Signals were there! But, alas, I had not counted correctly on the vagaries of men's minds! Some British telegrapher against whom I shall carry a grudge to my grave had "bulled" my cable, for it reached Armstrong reading "SEND MGES", and he did! He sent "MGES" over, and over, and over until I was sick! He kept it up the entire night, regardless of schedule, and no earthly way of stopping him! I remember getting a laugh out of it by conjuring up pictures of the "Old Man" spitting on the cat, but I could not forgive myself for exercising so much thrift. I wished that I had sent cables to Hartford and home and to Warren G. himself apprising them of the facilities available, for then I am quite sure my ideas



Special regenerative receiver, range 160 to 500 meters, used at Ardrossan and London.

for Pearson to believe that only 1 KW had been used, while I felt quite certain that the legal limit had not been exceeded. The frequency of the wave was *unusually* steady, and for this reason it had been possible to build up excellent signals by taking advantage of resonance in the telephones. To offset this belief, however, there remained the fact that we had not even heard indications of other stations after 1BCG shut down at 1:59 A.M. and I began to wonder whether or not 1BCG might be the only station which would get over in real style. I then decided that no one thing would forever redound to the credit of amateur radio more than the transmission and successful reception of a complete message and I wired Armstrong direct as follows: "Signals wonderful send messages starting one Greenwich" and went to bed with a singing heart and thoughts of the coming night when we would be copying (perhaps) messages via 1BCG from Hartford, and my home, and even from Warren G. Harding himself—who could say.

And, when we were on watch again it was "Allah be praised!" Nature was in a

on the subject would have been, finally, correctly interpreted.

My log for December 10th-11th reads: "Got on job a bit before twelve feeling very fit as a result of extra bit of sleep during afternoon and evening. Was most worn out. Take time signals from POZ and then do a bit of rearranging. I rig up external heterodyne for beating on my amplification frequency, hoping this will be better than using amplifier as autodyne, because of greater ease of adjustment.

"Get set at about 12:50, and at a few minutes past one, pick up 1BCG, sending 'Mges' over and over. Signal very strong and steady. Static very strong too, and have considerable difficulty to get signal-to-static ratio up. He fades more than last night. At 1:14 he says: 'three minutes'. I expect him to start sending messages, so anchor on him, making adjustments for improvement from time to time, and am very thankful for such a fine signal to work on.

"Pearson makes frequent excursions up and down the line, and endeavors by every means to get the static out and get the signal, but at 1:15 he faded out.

1:16—There, but unreadable.  
 1:17—There, but unreadable.  
 1:18—Faded out.  
 1:20—Returned a bit. Static getting heavier and adjust to reduce. Now have him saying "Mges" over and over.  
 1:22—Faded out 10 seconds and back.  
 1:23—Faded out 20 seconds and back.  
 1:24—Faded out 10 second and back.  
 1:25—Weaker.  
 1:26—Weak but steady.  
 1:27—Very weak and very steady.  
 1:28 and 1:29—Coming up very strong and steady.  
 1:30—Fades a bit.  
 1:31—Long dash, very strong and steady.  
 1:32—Fades a bit, but back again.  
 1:33—1:45—Very strong and very steady. Says "GE PF" and stops.  
 1:50—Back again, after five minutes shutdown, and new operator now.  
 1:51—Says "Minute, minute sn" and shuts off.  
 1:53—Long, unsteady, bubbling dash, and immediately much stronger than at any other time. Can read him throughout tent with 'phones on table, and wind howling outside. "Tests VV Mges de 1BCG"; etc., etc.  
 1:57—Falls off a bit, but still good, saying "R R Mges de 1BCG."  
 1:58—Fades to just audible for 20 seconds.  
 1:59—Coming up.  
 2:00—Just audible and out five seconds.  
 2:01 to 2:04—Strong and steady.  
 2:05—Almost out for 20 seconds.  
 2:06—Readable—back to normal and now reading 'phones down.  
 2:07—Subnormal—slowly weaker, out five seconds, rising and falling. Static still quite severe, much worse than last night.  
 2:08 to 2:12—Readable, rising, falling, weak. Suddenly jumps to normal for ten seconds, and fades to readable.  
 2:14—Stronger.  
 2:15—Says "Three minutes."  
 2:18—In again, now another operator sending.  
 2:21—Continuing good and steady.  
 2:23 and 2:24—"PF PF de 1BCG Test Test", etc., etc. Fine, steady and strong, fading a bit, but never out.  
 2:27—We jarred oscillator off setting and lost him, but back OK.  
 2:31—Says "Min bi 3 mins" but starts immediately and says "QRV".  
 2:32 to 2:38—Weaker but readable.  
 2:40—Accumulator failed, lost him in making change.  
 2:53—Going OK "Godley Mges."  
 2:56—"QRV"  
 2:59—He pauses. Very strong and steady during this period.  
 3:02—We talk and miss a phrase.  
 3:00 to 3:15—Very strong and steady.

Says "Bi 3 mins de 1BCG 30." We go out and stretch.

3:27—He is just now starting with another long dash and says "QRK Godley?" Another operator now. Signals thoroughly uniform. He sends "PF" in American Morse, probably John Grinan.

3:40—"PF" in American Morse twice.

3:43—"2ZE" twice. He has been wonderfully uniform since 3 A.M.

3:49—Pick up 1ARY, saying "QRV".

3:53—1BCG comes in again. Also following from 1ARY: "From 1ARY to 2VA—we will play again at football next fall. No sig." "2AJF from 1ARY No sig. HW 2AJF de 1ARY ar."

3:55—1ARY very slowly: "next fall no sig. 2AJF de 1ARY". Very steady.

3:57—1BCG still going *strong*, steady, and sharply, says "30" at exactly 4 A.M.

4:02—In again, very strong and steady.

4:05—Decide 1BCG is not going to send messages so leave him. Static fallen off rapidly in last hour, and wind has gradually shifted from southwest to northwest. Getting colder. Clears up a bit, but begins raining again about 4 A.M.

4:10—Some continuous wave calling 4GY. Can't read him for static.

4:17—1BCG still steady and *strong*.

4:18—Stops for a few minutes.

4:19—1ARY calling 1UN (CW) weak.

4:21—1ARY still calling 1UN.

4:23—1BCG still in; sends few V's.

4:26—1ARY calling 9BBF. "Here msg."

4:30—1BCG says "Three minutes AS". Some spark in too, but unreadable.

4:35—Several CW's and spark in, one CW quite loud but jammed. He is saying something about a message from "Richmond for West Palm Beach". From his fist suspect it is 4GL.

4:37—"R R Hello, Godley de 1BCG." Still very steady and fine. 1ARY calling 9BBF again, *seems fully as strong and steady now as 1BCG*.

4:43—"Hello Paul de 1BCG".

4:49—2FD calling 9XAH (CW). Fine, clear and strong. Pearson marvels at proficiency of amateur operators.

4:53—8ACF calling CQ (CW).

4:54—2FD calling 9XAH, says "GE".

4:58—1BCG still *very steady*. "Bi".

5:03—1BDT (spk) calling 2OM says: "GE 73 QTC." 1ARY (now spk) calls 1BIS. Both above fading.

5:09—Several sparks in too faint to read.

5:10—1BDT calling 1DY.

5:14—1BDT calling 1DY. (FFU jamming.)

5:15—Some buzzer calling 3PU.

5:18—2FP (ICW) in strong, very fine, steady signals. Sending his code word "HUZXJ."

5:23—1RU (CW) in strong and clear sending his code word "BPUSC". 1RU signs off at 5:25 A.M. 2FP still going

and can hear him all over tent. Very steady. Signs off at 5:30 A.M.

5:30—2BML in strong, steady, but his note varies considerably. Must be blowing at Rocky point and I wish Beverage could come up from Chelmsford and listen to his rotten note. However, Beverage is "there" on the antenna design. 2BML is sending his code word over and over very carefully and slowly, "FSXVG". He is much easier to read unheterodyned.

5:37—2BK is in (spark) working locals he says "OK tried anything yet OM".

5:40—1BDT in working a 3 station.

5:43—1BGF calling eight station.

5:44—1BCG still going strong. "V's".

5:49—8XV sending "Test" (CW.)

5:53—1YK calling 8AQV (CW). "LXCAM" coming through the QRM but cannot get his call due to jamming and his fades.

5:55—3BP (spark 60 cycle synchronous) Very strong.

5:57—LXCAM in again, but don't get his call. (500 cycle modulated CW).

6:00—1BCG "Test Godley". Still steady.

6:03—1XM signing off, ICW. 2EH (CW) calling 9ZJ—both good, but don't hear 9ZJ sign, although recognized his note and his fist.

6:05—2BK calling 8AYN. Strong.

6:19—2DN calling 8AYN; also strong.

6:23—1XM in, 500 cycle note, may be spark.

6:31—Someone says "Must put some wood on fire, old man." Think it is 2EH again.

6:39—A squeak box freaks in, and I am dumb-founded until I learn it is a French vessel. (FFV jamming.)

6:43—2EH (CW) calling 8AAH.

6:50—Close down to get a check on MUU. Colder; wind now in north. Very dark. A glorious night! And I hope that some of the English boys have had a look-in too. Surely, with their high frequency magnification they should do wonders on a night like this. I hope they have. I get a great deal of pleasure out of thinking about the glee with which MUU's message will be received tomorrow morning. How Warner will measure his head for the new spring hat! How old man Maxim will carry a face split from ear to ear. How Armstrong, Grinan, Burghard, King, Amy, Cronkhite and Inman will go around with chips on their shoulders and chests stuck out. 1BCG is some station, and Pearson and I both agree 1BCG was commercial signal 3 to 6 A.M. Some of the boys will be very much surprised too, because have heard some who never dreamed of getting over.

"The feature of the evening was the very fine and steady signalling from 1BCG. His continual transmission enabled a series of careful adjustments all along the line for a maximum effectiveness of antenna and

apparatus. Towards the last of test static had decreased, and was able to get "clear air."

"The patience and clocklike precision of shifts at 1BCG is deserving of great credit. Pearson is greatly impressed both by the enthusiasm displayed by all amateurs in America, and by the way this receiving outfit works.

"I am anxious for news from home, and cabled 1BCG as follows: 'Send home news.' Wired Coursey: 'Heard 1RU BPUSC, 2FP HUZSJ, 2BML FSXVG, also spark 1ARY, 1BDT, 2BK, 2DN, 3BP; undamped. 1ARY, 1BCG, 1BDT, 1BGF, 1YK, 1XM, 2FD, 2EH, 8ACF, 8XV, strong, reliable, thrilling.'"

In connection with this night's results, the following is to be noted, that the reception of so many signals was a combination of adjustments resulting from having station 1BCG to work on, and of transmission conditions which seemed, after several hours' hesitancy, to have decided finally to let through a great number of stations. The extent to which this condition persisted is evidenced by the fact that, whereas during the early evening and prior to a series of adjustments of the Beverage wire it was just possible to read 1BCG through static, later the combination of static-eliminating adjustments and conditions made it possible to read at least two stations whose output is not greater than 30 watts.

Subsequent to 4:30, many sparks and CW signals would come flicking in for short periods of time and then go out again, before it was possible to get their signs, and in many cases to even hear what they were calling.

I cannot at this time too heartily condemn the practice of stations working locally without using their call letters. On at least a dozen occasions I very carefully tuned in stations to listen to them for periods ranging between one and three minutes, to find that my effort had gone for naught, since the stations in question suddenly stopped working without using their station calls.

Between 4:30 and 6 there were times when so many stations came in that it was impossible to read any. At such times as these I was very strongly reminded of the interference conditions near New York City. These conditions were duplicated exactly, excepting that the strength of signals was not as great. The number of stations audible; however, was fully equal to the number audible when listening in, in the vicinity of New York.

Monday, December 12th:

"1 A.M.—In late, account finishing up log. On at 1 A.M. adjusting on 600 meters. Partly cloudy, north wind all day, now southwest, but remains cooler. No rain today.



1:25—Go to short waves. Static intermittent, medium heavy clicks. Several American amateurs in too weak to read. 1BDT sending "Test", spark very strong and steady. "Transatlantic tests". Strong harmonic from some H.P. station, sending press and fading in and out. 1BKA sending "test" (CW). FFU jamming. 1XM (ICW sending "test". FFU jamming. Dozens of them in working, wonderful.

1:45—1XM in again.

1:50—1BCG says "Bi 1 hour."

1:55—2EH (CW) "Test." Lots of jamming from the Holland stations.

1:58—2FP in strong. (ICW).

2:05—2ARY (ICW) "Test". Lots of QRM from Poldhu's press on harmonic. Other press schedules also going, and all seem to have harmonics. Makes it difficult.

2:11—3FB spark. "Test." (QRM FFU.)

2:19—2AJW calling 20E (CW). (30 watts.)

2:24—2EH (CW) calling 8AKV. (UAT arc jamming.)

2:35—2EL calling. (Weak.)

2:39—1ARY (CW) working.

2:50—2EH calling 8AFD very steady. 1BCG in with messages.

2:52—He starts: "Nr 1 de 1BCG words 12, New York. Date December 11, 1921, to Paul Godley, Ardrossan, Scotland. Hearty Congratulations. (Signed) Burghard, Inman, Grinan, Armstrong, Amy, Cronkhite." Received from 1BCG finishing at 3 A.M. He says "Bi two hours". (Last heard of him.)

3:03—2EH working 2XQ. Very steady.

3:11—1RZ in (CW), readable; also many weaker ones jammed by high power stations.

3:15—Shut down for slight shifts. Had small regenerative receiver in. Heard several CW stations faintly, but only one readable.

4:05—Back on super-heterodyne receiver. Apparently all faded out. Hear only an occasional 20-second amateur spark or continuous wave, and no more. Weather again changing here. FFU, who has been jamming all evening, is rising and falling rapidly, being very weak most of the time. Battery getting low, but do not blame it.

5:54—Heard nothing more.

6:05—Nothing more. Close down. Wired Coursey: "Code LXCAM call jammed, also 1BKA, 1RZ, 2ARY, 2AJW and 3FB."

"December 13, Tuesday—On 1:30 A.M. account oversleep, after up 24 hours straight. Partly cloudy. Bright moon. Wind northwest with occasional squall. A bit frosty.

1:30—Nothing in on short waves. Go through amplifier adjustment. Medium static. Medium to moderate clicks, and a good deal of interference from high power press-sending stations.

1:45—Wind begins rising rapidly and

cold getting intense. Ship stations going strong and static quite heavy on 200 meters, though much better than on vertical aerial. Nothing in on short waves which can be read.

2:10—Static growing worse. FL's arc jamming too.

2:15—Continuous wave station in on 225 meters, but can't make him out; and it is even difficult to get him turned on account of atmospherics. Atmospherics seem to have reached a sudden peak, and now are steady, louder crashes having flattened out into continuous roar.

2:40—Static killing everything, can't even read harmonics nearby from high power stations.

2:55—Swapping tubes for improvement of amplification. No marked improvement over those picked initially.

3:00—Static increasing, still bright moonlight, and partially cloudy. Wind still in northwest. Out for eats.

3:15—Static increasing and occasional squalls and cold rain.

3:22—Carefully tuning oil stove and succeed in increasing output 50 per cent.

3:25—On 600 meters, comparatively quiet.

3:30—FFU on 600 meters. Have not heard him on 240 tonight.

"Note: Although on all previous nights we have looked diligently for stations on 250, 275, 325, and 375, none are to be heard even when conditions seem at their best, at which time very fine signals are coming through from Cape Race on 600 meters.

3:30—Pearson calls this a "proper washout."

3:40—Harmonics from high power stations only. Clifden's very loud.

4:00—Static continues heavy and continual muffled roar. Hearing nothing on short waves.

4:01—Fairly strong, unsteady CW signal on 1BCG's wave, send V's; fading fairly strong at times. Lose him entirely trying to better him.

4:24—FFU begins floating in on 240 meters.

4:30—FFU faintly through static on 450 meters.

4:45—On 600 meters, static heavy there too, and not much doing. Hear no sign of Cape Race.

4:50—Some 500 cycle spark on 200 meters calling CQ, but do not get his sign.

4:52—Non-synchronous spark, loud, sounds like British commercial station, but don't get his call.

5:05—Nothing coming through, static falling off a bit, but rather severe yet.

5:15—Nothing doing.

5:30—600 meters very quiet. Static clicks coming in again. Pearson getting very sleepy. Shut down to go over the line and eat a bit.

(Continued on page 36)

## Station 1BCG

A Paper Presented by George E. Burghard at meeting of Radio Club of America, Columbia University, Dec. 30, 1921.

*Here is a complete description of a station that has shattered all kinds of amateur records. 1BCG has been heard in places where a "1" never got before; it has handed messages three nights running to the Pacific Coast; it has been copied solid in Scotland; heard in Holland on a tuned-plate regenerator and detector-two-step; and has just been reported by a ship's operator as QRK at dock in Hamburg, Germany, on the ship set.—Ed.*

**B**EFORE going into the description of station 1BCG it may be well to consider for a moment the history of transatlantic amateur communication.

The idea of transmitting American amateur signals to the Continent originated with one of the prominent members of the Radio Club of America before the world war when Mr. L. G. Pacent presented the matter for the consideration of the board of direction. Nothing definite was accomplished, however, and when Mr. Thomas Styles went to France after the war, Mr. Pacent suggested that the club erect a station to attempt communication, but the proposition was abandoned as too costly at

and the first test was run under their auspices. The periods of transmission, however, were too short and no signals were heard in Europe. Then it was decided by the League to have another test the following winter, making the periods of transmission longer, and to send a representative to England to receive the American signals. Mr. P. F. Godley was selected as the logical man to go to England. He sailed for England in November, 1921, and it is here that the story of 1BCG begins.

On November 18th six members of the Radio Club of America at an informal meeting decided to build a transmitting station that would be heard in Great Britain. The six men were E. H. Armstrong, E. V. Amy, John F. Grinan, Walker Inman, Minton Cronkhite, and G. E. Burghard.

Various locations for the station were suggested and it was finally decided to build at Greenwich, Conn., on the site of Mr. Cronkhite's station 1BCG. Thru the courtesy of Mr. E. P. Cronkhite the necessary land and facilities were obtained. The antenna and transmitter were designed and decided upon and work was be-

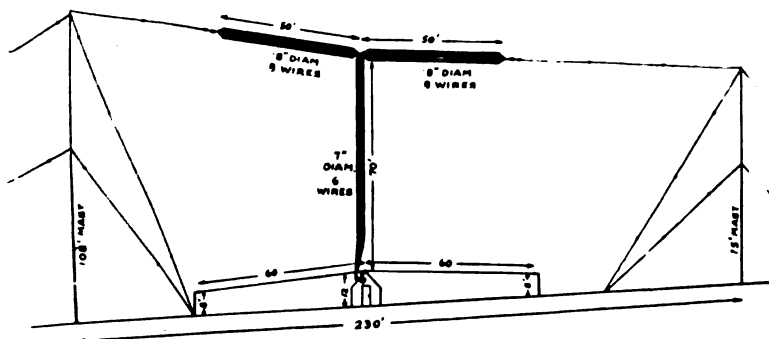


FIG. 1 Antenna at 1BCG.

the time. Some time after this Mr. Philip Coursey of "The Wireless World" took up the matter with Mr. White of the Wireless Press with like result, everyone being sceptical as to the success of the affair. Then Mr. M. B. Sleeper, at that time radio editor of "Everyday Engineering", took the idea up in earnest and laid the plans for the first amateur transatlantic test but was later forced to give it up. The American Radio Relay League took up the task at Mr. Sleeper's request, where he left off,

gun at Greenwich on November 19th. The staff worked night and day in snow and rain until finally on November 30th the antenna and counterpoise were in place. The transmitter, which at that time was of the self-rectifying type, was also well under way and the first signals were sent out at 10:40 p.m. November 30th, with expectedly poor results. Much trouble was experienced from then on until on Dec. 5th it was decided to supplant the A.C. system with a D.C. master-oscillator set.

This system, which will be described in detail later, was made permanent and was used in the transatlantic tests and is still in use at IBCG at the present time.

The antenna system used is of the type T cage with a radial counterpoise. The dimensions are as shown in Fig. 1. The antenna proper is hung between two pipe masts 230 feet apart and 108 and 75 feet high, respectively. The two horizontal sections of the cage are each 50 feet long, 18 inches in diameter, and consist of eight phosphor-bronze wires. The vertical section is 70 feet over the top of the counterpoise, 7 inches in diameter, and consists of 6 wires. The counterpoise wires can be seen in relief stretching from the top of the transmitting shack which was located directly under the middle of the antenna, thus placing the transmitter in the center of the system. A bird's-eye view of the counterpoise is shown in Figure 2.

As can readily be seen the system is divided into two fan-shaped halves, each containing 15 wires all of equal length, i.e., 60 feet, and radiating from the transmitter as a center. The reason for this division of the counterpoise is of no im-

portance since it was intended to prevent harmonics in a predesigned system which was never put into practice. The natural period of this system of antenna and counterpoise from actual measurement proved to be between 190 and 195 meters.

The resistance of the antenna and counterpoise thru a range of wave lengths from 200 to 330 meters was found to be as follows:

| Wave Length<br>Meters | Resistance<br>Ohms |
|-----------------------|--------------------|
| 200                   | 40                 |
| 210                   | 31                 |
| 215                   | 18                 |
| 225                   | 16                 |
| 230                   | 15.5               |
| 240                   | 14                 |
| 270                   | 12.5               |
| 290                   | 17                 |
| 310                   | 12                 |
| 330                   | 9                  |

Unfortunately no further readings were taken but since the working wave length of the station was 230 meters a fair idea of the antenna efficiency can be obtained from the figures at hand. The sudden rise in

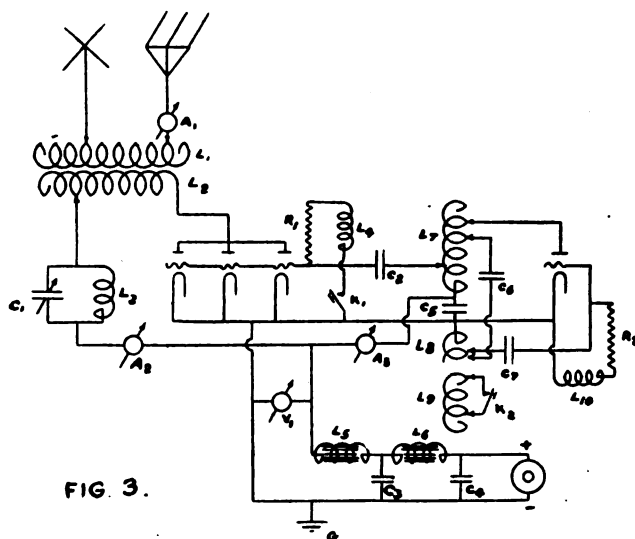


FIG. 3.

#### Constants for Fig. 3

|                      |                            |
|----------------------|----------------------------|
| A <sub>1</sub> ..... | 0-15 thermo-couple ammeter |
| A <sub>2</sub> ..... | 0-3 ammeter                |
| A <sub>3</sub> ..... | 0-500 milliammeter         |
| C <sub>1</sub> ..... | variable                   |
| C <sub>2</sub> ..... | 0.002 mfd.                 |
| C <sub>3</sub> ..... | 0.250 "                    |
| C <sub>4</sub> ..... | 0.0017 "                   |
| C <sub>5</sub> ..... | 0.250 "                    |
| C <sub>6</sub> ..... | 0.001 "                    |
| C <sub>7</sub> ..... | 0.002 "                    |
| L <sub>1</sub> ..... | 5½ turns, UL-1008          |

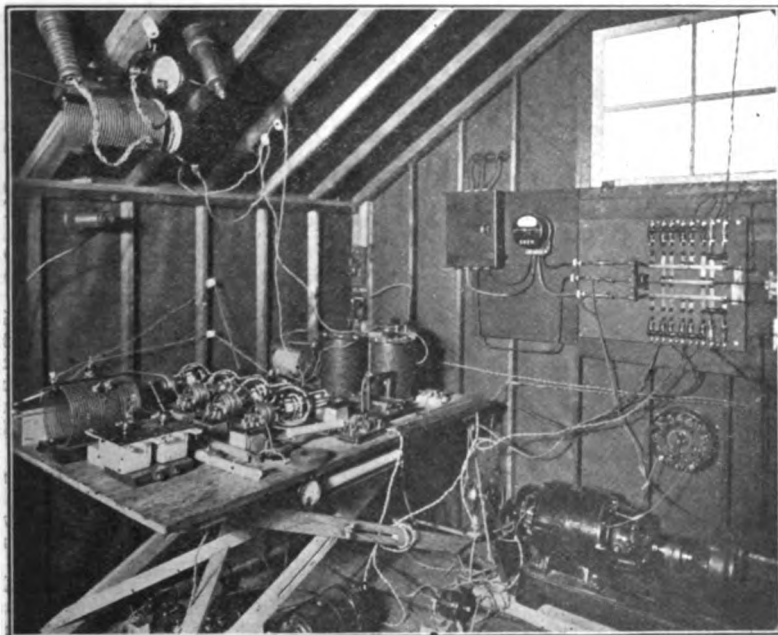
|                                       |                       |
|---------------------------------------|-----------------------|
| L <sub>2</sub> .....                  | 36 turns, 5" diam.    |
| L <sub>3</sub> .....                  | 3 millihenry choke    |
| L <sub>4</sub> .....                  | 3 millihenry choke    |
| L <sub>5</sub> .....                  | 9 henries             |
| L <sub>6</sub> .....                  | 9 henries             |
| L <sub>7</sub> .....                  | 16 turns, UL-1008     |
| L <sub>8</sub> .....                  | 8 turns, UL-1008      |
| L <sub>9</sub> .....                  | 3 turns, UL-1008      |
| L <sub>10</sub> .....                 | 3 millihenry choke    |
| R <sub>1</sub> .....                  | 2500 ohms             |
| R <sub>2</sub> .....                  | 1000 ohms             |
| V <sub>1</sub> .....                  | 3000 volt meter       |
| K <sub>1</sub> , K <sub>2</sub> ..... | relay signalling keys |

resistance at 290 meters was later found to be due to the receiving antenna which had a fundamental wave length of approximately 290 meters.

No real earth ground was used in the station except to ground the filaments of the transmitting tubes, and for receiving; this consisted of several four-foot ground stakes driven into the ground.

The design of the transmitter centered about one main idea, the production of that type of 200 meter wave which would be most effectively handled by the super-heterodyne method of amplification and that type of audible signal which would be

within the narrow limits permitted by the resonance curve of the diaphragm and the physiological characteristics of the ear. There must be no variation in this frequency which will disturb the mechanical resonance of the diaphragm, nor flutter in note which will disturb what may be called the physiological resonance of the ear. The permissible limits of variation in frequency for a 1000 cycle note are well under 100 cycles. Hence for heterodyne reception at 200 meters or 1,500,000 cycles, a variation of frequency of less than 1/100 of one percent would be extremely disturbing to the operator and a variation of 1/20 of one



Interior view of the station.

most effective on the combination of the telephone and the human ear.

To meet the first condition, that is, the electrical requirements of the super-heterodyne, a pure undamped wave must be used. It is obvious that the super-heterodyne with its great selectivity and highly resonant system cannot give its maximum response when there is any discontinuity or variation in amplitude in the transmitted wave. Undamped waves must be used, waves of a type which can be obtained only from a vacuum tube oscillator with a continuous current plate supply.

To meet the second condition (the combined electrical characteristics of the telephones and the physiological characteristics of the human ear) a current must be produced in the telephones which corresponds with the natural period of the diaphragms and which remains constant

percent would be sufficient to carry the note into an inaudible frequency.

The whole proposition therefore comes down to the construction of a vacuum tube transmitter producing undamped waves of an absolutely constant frequency which stays constant with an instantaneous application of a load of 1 K.W. There is but one type of transmitter which can possibly meet this condition—the master-oscillator-amplifier type with a motor-generator for the plate supply.

The general layout of the transmitter is illustrated by Figure 3. Four type U.V.-204 Radiotrons were used, one as the master oscillator, three in parallel as amplifiers. The filaments of these tubes were connected in pairs of two in parallel and each pair was lighted by A.C. obtained from the ordinary type of filament-lighting transformers. The plate supply was ob-

tained from a double-commutator 2200 volt 1.5 K.W. continuous current generator with A.C. drive.

The master-oscillator circuit employed was of the standard split inductance type with a fixed tuning condenser of the rather large value, for 200 meter work, of .001 mfd. The inductance consisted of a helix of 25 turns of copper strip wound edgewise, having a diameter of about 6" and a length of 9". This choice of constants was arrived at largely on account of an accident to several condensers of smaller

were of the open-core type, wound with No. 22 B. & S. wire, each having an inductance of 9 henrys and a direct current resistance of 85 ohms. The capacity of the two shunt condensers was .25 mfd. each.

The method of signalling used was as follows: The master-oscillator was connected permanently to the generator and ran continuously whenever the motor-generator was running. Its circuit was never broken. Signalling was accomplished by means of two magnetically-controlled keys. The first opened the grid leak circuit of the amplifiers. The second simultaneously shortened the wave length of the master-oscillator about 5 meters by short-circuiting a couple of turns of a coil in inductive relation with the master-oscillator circuit. Under steady operating conditions this transmitter maintains 6 amperes in the antenna with an input of 990 watts into the plate circuits of all four tubes. The power in the antenna for this current is 558 watts, corresponding to an antenna resistance of 15.5 ohms. This gives a plate efficiency of about 56% with 2200 volts on the plates. On

account of various breakdowns in different parts of the apparatus this output was not obtained and the set was not in condition for steady operation until 1:10 A.M. of December 9th.

There are some points of interest about the set which are novel. Probably the most important is the stability of the master-oscillator. This is due to the type of oscillating circuit and the relatively large power of the master-oscillator, and to the tuning of the plate circuit of the amplifier which permits the neutralization of the reaction of the amplifier on the master-oscillator system. This is accomplished by adjusting the tuning of the amplifier plate circuit and the coupling with the antenna until the plate current of the master-oscillator tube remains unchanged when the key is closed.

In addition to this effect the series tuning system in the amplifier plate circuit has the very important advantage of increasing the transfer of energy to the antenna circuit when the antenna coil has but a few turns. It therefore assists in operating the antenna system close to its fundamental wave length.

It is interesting to note here that great difficulty was experienced in the first few days of operation in obtaining reliable information regarding the steadiness of the note. This was due to the fact that signals from 1BCG were sufficiently strong to affect and alter to a considerable degree the frequency at which receiving sets with-

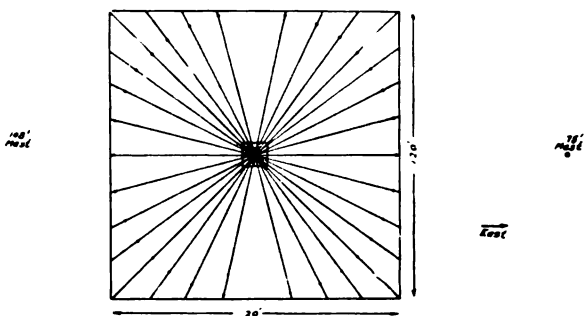


FIG. 2 Counterpoise at 180°

capacity in the master oscillator circuit on the first night of the tests. The only available condensers capable of standing the required voltage were two .002 mfd. mica condensers which were connected in series to give .001 mfd. The other constants of the circuit were then adjusted to fit this capacity. The usual grid condenser, with a high resistance leak and choke coil connected between grid and filament, was used.

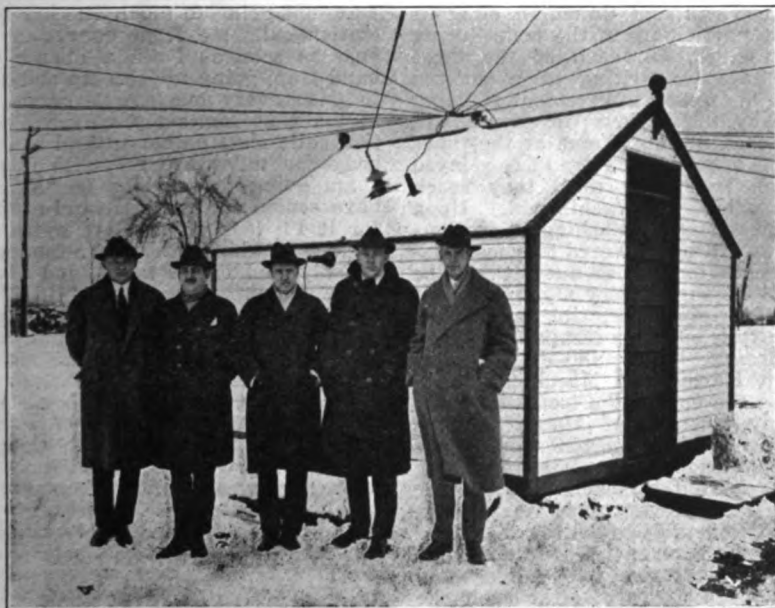
The amplifier consisted of three tubes with their respective grids and plates connected in parallel. The grids were connected thru a series condenser to a tap on the plate side of the master-oscillator inductance. The usual grid leak and choke coil were connected between grid and filament. The plate circuit was coupled to the antenna thru a two-coil oscillation transformer. The primary or plate side of this transformer consisted of a coil of 36 turns of litz, having a diameter of 5" and a length of 3½". The secondary or antenna coil consisted of about 6 turns of edgewise-wound strip 6" in diameter. The plate circuit of the amplifier was tuned by means of a capacity consisting of three .005 mfd. variable air condensers connected in series to withstand the voltage. The path for the continuous current in the plate circuit was completed by a choke coil connected across the three condensers.

The filter circuit consisted of a two stage series inductance, shunt capacity filter, both inductances being placed in the positive generator lead. These inductances



in a radius of fifty miles were oscillating. This resulted in a bad note. The solution to this difficulty was found by setting up a self-heterodyne detector in the station with 150 volts on the plate, without a stopping condenser, and with a tuning circuit of small inductance and large capacity. By adjusting the frequency of this circuit to one third of the frequency of the station, beats were obtained between the fundamental of the station and the third harmonic of the receiver. This enabled the

cooler operation many stations are heard sending in Transatlantics. Finally sent CQ to Godley with 3 amps. in antenna. More tubes arrive—set is in operation until condensers in the master-oscillator circuit heat up so that it is advisable to shut down." "Dec. 8—Much trouble is experienced with condensers in master-oscillator circuit. Tested for adjustment all nite. 1:12 A.M. finally got condensers fixed with 6 amps. radiation and worked until 6:35 A.M. All OK now". From this it can be seen that



The station building at 1BCG and five of its owners. Left to right, Messrs. Amy, Grinan, Burghard, Armstrong, Cronkhite. Mr. Inman is missing in this photo. Note the counterpoise radiating from the top of the station, and the lead-in from it and the antenna.

frequency of the station to be observed perfectly. Observation on a windy night, when the notes of all C.W. stations heard were varying so badly as to be almost unreadable, showed the frequency to be absolutely unaffected by the motion of the antenna. The reports on this set from all parts of the country show beyond question that radiation of this kind is superior to very many times the energy radiated from the ordinary types of C.W. transmitters.

In connection with the actual operation of the station it will be interesting to quote from the engineering log in order to give an idea of the difficulties encountered: "Dec. 6th—During the evening the master oscillator is connected up. Two amplifiers in use. Tubes running very hot. A CQ was sent out at 3:30 A.M. and condensers boil over." "Dec. 7—One tube is found to be defective leaving only one amplifier. While we are adjusting the master-oscillator for

the station was actually not in operation until the 9th of December and in the short period of three weeks to date has accomplished some amazing long-distance feats.

1BCG's signals have been heard in practically every state in the Union; in Scotland on Dec. 9, 10 and 11; England, Holland, Porto Rico; Vancouver, B. C.; California and Washington. The greatest distance covered is to Amsterdam, Holland, approximately 3800 miles, mostly over water, and 2600 miles over land to Smith River, Calif. Last but not least 1BCG has established new records by sending three complete messages to 6XAD in Avalon, Catalina Island, Calif., and one 12-word message to Ardrossan, Scotland, at 9:45-10:00 P.M. Dec. 11, 1921; all with an input of 990 watts and wave length of 230 meters.

Photographs of 1BCG, thru the courtesy of Mr. J. Edw. Brown, of 1BKA, Glenbrook, Conn.

# Governors'-President's Relay

*By The Traffic Manager*

**O**N March 6th, 7th, and 8th we are going to test our network of relay stations throughout United States and Canada by relaying a message from the Governor of every State in the Union to President Harding at Washington, D. C.

Every American and Canadian amateur is invited to participate in the tests during the three nights. On each of the three nights, messages consisting of about ten words each, addressed to President Harding and signed by the various Governors, will start from the different states at the times shown on the schedule and are to be relayed from station to station until they reach their destination at Washington. Upon receipt of messages by Washington stations the messages will be delivered to some amateur in Washington whose duty it will be to collect all messages every night; see that the office of origin, date, time and check are correct; type out all messages on official A.R.R.L. message blanks and deliver them to President Harding on March 9th. Accordingly, at the end of the tests on March 8th or early morning of March 9th the central station in Washington should have 48 complete messages. The reason for using three nights is that atmospheric or other interference may prevent good relay work, and we want to be able to deliver the entire 48 messages, one from each Governor. However, the central station will deliver only one copy of each message, altho each one will travel to Washington each of the three nights. Washington stations will keep an accurate check as to time of receipt of each message on each night and since we know the exact time each message will start we can get an excellent idea of how much speed we can make with the various messages.

One very important point to remember is that we urgently request every amateur who participates in the tests to keep a complete log in regard to what messages he handled, what stations he heard, from which stations he received his messages, and to what stations he gave them. It is requested that copies of all logs be mailed to Hartford in order that we may give credit where it is due and know the routes over which the messages were relayed. We must have all logs in the Hartford Office not later than March 15th. Mail them to F. H. Schnell, Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn. A complete story of the affair will appear in QST.

I expect to sit in at 1AW during the tests and I expect to operate on one of the nights and here is what I suggest you do,

at least this is what I am going to do: About 9:55 P.M. Eastern Standard Time I am going down and oil up the old gap and "start up". Then I'm going to pick out some good strong reliable signals from the direction of Washington and keep those call letters before me for future reference. I am not going to touch the key until some station calls me from over east or north. Just as soon as I see a chance to lend a hand I am going to open up and do my best to push every message through to Washington that comes my way. When a station calls me I do not intend to jam everybody for miles around with idle chatter; I am going to ask him to "K". When I have copied his message and acknowledged for it I'll look on my list which gives me an idea of what stations are coming through reliably and consistently, and give one of them a call. If he says, "QRK" I'll give him my messages and then "pipe down" until it is time to lend a hand again. If my first man says signals are not QRK I'll try some other station.

Let us not be an ether hog. Let's give every man a chance to do his bit and if he falls down let's help him along. There is no reason why we should have jamming with messages coming from two States widely separated.

The following schedule gives the starting time for each State in Eastern Standard Time.

## SCHEDULE

March 6-7-8.

### *Eastern Standard Time.*

10:00 P.M.—Louisiana and Ohio  
 10:05 P.M.—Wisconsin and Florida  
 10:10 P.M.—Illinois and S. Carolina  
 10:15 P.M.—Arkansas and W. Virginia  
 10:20 P.M.—Missouri and Virginia  
 10:25 P.M.—Iowa and Kentucky  
 10:30 P.M.—Minnesota and Tennessee  
 10:35 P.M.—Texas and No. Carolina  
 10:40 P.M.—Oklahoma and Indiana  
 10:45 P.M.—Kansas and Georgia  
 10:50 P.M.—Nebraska and Michigan  
 10:55 P.M.—So. Dakota and Alabama  
 11:00 P.M.—No. Dakota and Mississippi  
 11:05 P.M.—New Mexico and Maryland  
 11:10 P.M.—Colorado and Pennsylvania  
 11:15 P.M.—Wyoming and Delaware  
 11:20 P.M.—Montana and New Jersey  
 11:25 P.M.—Arizona and New York  
 11:30 P.M.—Utah and Connecticut  
 11:35 P.M.—Idaho and Rhode Island  
 11:40 P.M.—Nevada and Massachusetts  
 11:45 P.M.—Washington and Maine  
 11:50 P.M.—Oregon and New Hampshire  
 11:55 P.M.—California and Vermont

# Practical Radio Amplification

By Robert C. Higgy

**R**ADIO frequency amplification until very recently has been an unknown thing in the average short-wave station. Some of its advantages have been pointed out from time to time, but very little data on actual operation have been given. The following has been written in an endeavor to throw a little more information into the melting pot and give a few very definite ideas on the subject.

Radio amplification is possible on 200 meters, contrary to general opinion, with all of the present tubes now available. It is entirely practical from an operating standpoint and does not necessarily entail complicated adjustments nor special low capacity tubes.

A few of the advantages are:—

- (1) *Increases weak and strong signals by the same ratio and is not dependent upon the square of the applied voltage as in a detector, which repeats the strong signals much louder than the weak ones.*
- (2) *Boosts signals before rectification which would be otherwise inaudible, regardless of the amount of audio amplification.*
- (3) *Gives less amplification of extraneous and tube noises.*

Amplification at radio frequencies on 200 meters may be accomplished by two different circuit arrangements which are shown in Figures 1 and 2. Figure 1 shows a cir-

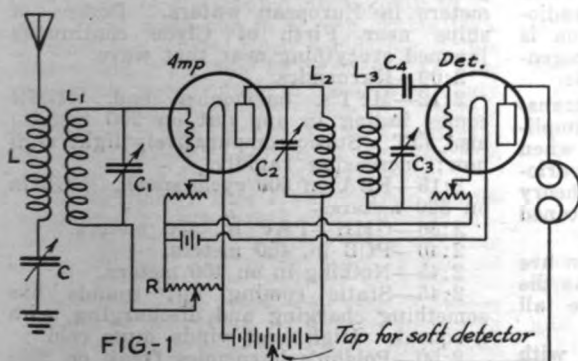


FIG-1

cuit arrangement using a two-winding transformer while Figure 2 is a circuit using a single-coil transformer, the same coil being common to the plate and grid circuits of the two tubes which it couples. It will be seen from Figure 1 that when the coil in the plate circuit of the first tube is tuned to the same frequency as that of

the grid circuit and incoming signals, the condition for maximum amplification, the tube will oscillate, similar to the standard regenerator principle. In order to keep the tube from oscillating three methods may be used: (1) detuning the transformer enough to keep it from oscillating; (2) by using a stabilizer or C-battery potentio-

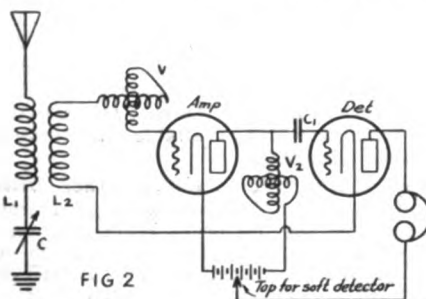


FIG 2

meter to vary the grid potential similar to the method in which we use an A-battery potentiometer to vary the plate voltage on soft detector tubes; (3) by inserting a resistance in the plate circuit or winding the transformer with very fine wire. Another possible method employed in one of the new radio-frequency amplifying transformers now available is that of using an iron core which, in effect, introduces a resistance in the circuit. However, this requires very careful design and construction. As a rule it is advisable to use both the stabilizer and a high-resistance transformer winding to get the greatest amplification in untuned repeating circuits. However, it is possible to get very good amplification with the plate circuit detuned enough to keep the first tube from oscillating, although the amplification is much less than at resonance. Greatest amplification is to be had when the transformers are tuned to the wave length of the incoming signals but obviously this means two additional adjustments. Fortunately introducing resistance in the windings has the effect of broadening the resonance curve, by virtue of the increased decrement, and makes the circuit assume a semi-aperiodic state and gives us fair amplification over a broad range of wave lengths without tuning for each individual signal, altho the amplification per

tube is nearly twice as much with tuned transformers as with untuned ones.

Reducing Fig. 1 for practical operation,  $L_1$  and  $L_2$  may be the primary and secondary of a variocoupler similar to that of the standard regenerator.  $C_1$  is the series condenser generally used and  $C_2$  is a secondary tuning condenser.  $L_1$  and  $L_2$ , the transformer primary and secondary respectively, should consist of 30 turns of No. 20 magnet wire on about a 3 inch diameter and preferably arranged so that the coupling may be varied.  $C_1$  and  $C_2$  are the tuning condensers for the transformer and should have a capacity of .0005 mfd.  $C_3$  is the detector grid condenser, usually of .0008 mfd.  $R$  is the stabilizer or C-battery potentiometer and should have a resistance of at least 200 ohms. One of the A-battery potentiometers now available will serve the purpose admirably.

The circuit will be found rather critical in adjustment but should give good amplification on 200 meters. Since the transformer has low resistance windings and hence a sharp resonance curve, it will only cover about twenty meters with good amplification for a set tuning adjustment of condensers  $C_1$  and  $C_2$ . In adjusting, a buzzer exciter may be coupled very loosely to the ground wire until proper transformer tuning and adjusting has been found.

Figure 2 shows an arrangement that has given remarkable amplification making use of the standard regenerator.  $L_1$  and  $L_2$  are the variocoupler primary and secondary,  $V$  is the grid variometer and  $V_1$ , the plate variometer.  $C_1$  is the usual series condenser and  $C_2$  the detector grid condenser. The plate variometer acts as the radio-frequency transformer. The operation is identical with that of the standard regenerator with no additional adjustments.

In all of the circuits using tuned transformers (as above) a regenerative amplification is experienced in the first tube when the transformer primary or the plate variometer is brought near resonance, the theory of which is similar to that of the tuned plate regenerator.

The principles of radio amplification are ideal for our short wave work whereas the principles of audio amplification are all wrong.

In comparing radio amplification with other methods, choose a weak signal and not a strong one as from the above it will be seen that weak signals are amplified as much as strong ones, which is not true of the other methods.

But little data is available on short wave radio amplification and it is hoped that the above information will at least lead to further discussion on this most important subject.

## Official Report of the Second Transatlantic Tests

(Continued from page 28)

6:00—Nothing in.

7:00—Copy MUU's report.

"Wired Coursey: 'Include yesterday's 8BU stop. Heavy atmospherics today.' (8BU logged by Pearson.) Coursey added to this: 'Many your stations heard by British amateurs. Details later.'"

December 13th—14th:

"In bed all day trying to keep warm and catch up on sleep. Get out a bit late. A cable from Clement via Coursey saying 2XB will transmit 450 meters continuously, CW, ICW and telephone 1 to 7 GMT this morning. A letter from Coursey saying 'They have been heard' in London, on British equipment and 'small British aerial'. I am very much pleased.

12:45—Find line and tent OK. Inspect grounds and start stove. Cold west wind, overcast, fleecy clouds. Static grinders. Clifden's harmonics particularly bad. POZ also has a strong harmonic going. FFU in good and strong and fading at 240 meters; also a harmonic from Poldhu, good and strong.

1:03—Some spark in, jammed by FUU and Clifden.

1:09—GMH in strong on 200 meters harmonic, also FFU.

1:25—Nothing of 2XB. Harmonics pretty bad on 450 meters.

1:30—GMH in. Also someone starting an arc.

1:45—Harmonics exceptionally bad; signals numerous on 300 and 600 meters. A great deal of intership work done on 300 meters in European waters. Dozens of ships near Firth of Clyde continually jammed everything near that wave.

2:00—Harmonics.

2:12—MFT's harmonics bad. GMH comes fading in and out on 200 meters; also JJT. Static comparatively light until now; increasing rapidly.

2:15—FBA on 500 cycle spark. FGR in on 320 meters.

2:30—GMH—PAF in, 450 meters.

2:40—PCB in, 450 meters.

2:45—Nothing in on 450 meters.

2:45—Static coming up; sounds like something charging and discharging, with a squeak. High west winds, quite cold.

2:50—Poldhu's harmonics freak on 200; also an American amateur freaking in and out. Non-synchronous gap. (Later more like GMH.) FFU fading in and out. This is a harmonic of his 600 meter wave, as is GMH's signal.

2:55—Very tired and sleepy.

3:02—Wind rising rapidly, and getting very cold.

3:10—Decide to turn in, nothing doing, and both greatly in need of rest.

"Wired Coursey: 'Colder, high winds, faint signals only. No reception.'"

It was on this night that Pearson had fallen asleep. The cold was particularly hard to bear. The wind whistled around our feet and came down in gusts on our heads. We pulled the oil stove around (it was directly underneath the table) and turned our boxes over so that our heads just stuck above the table. In this way the greatest possible portion of our bodies was exposed to what little heat was radiated by the stove.

Some time between 3:10 when we decided to turn in, and five o'clock, when we actually did turn in, I also threw my hands across the table and fell asleep. How long I slept I do not know, but I awoke suddenly with thoughts chasing around in my head to the effect that the "works" was on fire. In coming to I also awakened Pearson, who looked at me with eyes aghast. I immediately asked him if I had startled him, and he replied "What is the matter with your face? It is as black as ink."

The oil stove had taken a notion to smoke, and a good many of the papers, the log book, and a part of the apparatus, as well as the under side of the table, were thoroughly smoked up. My face laid across a crack, and when I had reached the hotel and had an opportunity to examine myself in the mirror, I could well understand Pearson's surprise.

It is growing rapidly difficult for me to remember the lack of enthusiasm on the part of both Pearson and myself to drag ourselves out of a warm corner by the open fire in the lounge at the hotel, in order that we might don rubbers, overcoats, and rain coats, and march out into the awfulness of the Scotch night, only to sit on a hard wood box in a very drafty tent. I remember several times wondering if this test would ever, *ever* be finished. As long as signals were coming in, there was plenty to keep one interested, and the nights passed very rapidly, but it was a continual fight against static and harmonics and cold and wet that drove one almost crazy.

In addition to this I was having to contend with a very heavy cold. I was subject to coughing spells which shook me from head to foot, and after which I felt as weak as a baby.

On Wednesday, December 14th, I almost decided to give it up. I had no hankering for an attack of pneumonia in Scotland, and I was advised on two occasions to forget all about radio and go to bed, unless I wished to be confronted with a serious illness of three or four weeks, with hospital attendance which was none too good. I am quite sure at this time if I had seen any weakening on Pearson's part I would have been only too glad to take advantage of it. I would like to say that I not only have the highest regard for Pearson's ability as an operator, but also for the courage—and

courage is the word—which he displayed in sitting up night after night, in a leaky tent, with high winds blowing, and heavy rains falling, and nothing but an occasional "wee drapple" and a very unreliable two-dollar oil stove to keep him warm.

At this time I was suffering from pains in the back, sore muscles, headaches, and a very stiff neck. However, towards the end of the week the weather was quite like summer, being very warm, and gentle southerly breezes were blowing, and we managed to carry on.

On Wednesday and Thursday, December 14-15, my log reads as follow:

10:30—Very light static. Only thing to be heard on amateur waves are harmonics from 600 meter stations and harmonics from "Olympic's" tube set. Listening diligently on all waves, up to 12:10, nothing doing.

12:30—Dead silence, except for Clifden's harmonic, and an occasional 600 meter harmonic.

12:45—Go to vertical antenna. FFU's harmonic stronger and static heavier. No signals. Winds changing from west to north.

At 1 A.M. Poldhu's 200 meter harmonic comes in on his press schedules. Fading in and out. Static coming up rapidly since change of wind.

1:13—FFI in on 200 meters (harmonic.)

1:15—Static worse. Pearson goes to end of line and readjusts resistance, resulting in marked improvement in static.

1:30—MPD, FFU, and FFI in on harmonics. Nothing more.

1:45—Ditto.

2:00—Go to 450 for 2XB.

2:30—Nothing from 2XB. Static again getting stronger.

2:45—FFU in occasionally, nothing on short waves.

3:15—Absolute void of signals.

3:30—Both getting so sleepy we can hardly see.

3:45—Still sleepy. Still no signals.

4:00—Ditto. Ditto.

4:30—Conditions have been the same for hours. No signals. We decide to turn in.

"Wired Coursey: 'Bright moon shine, summery weather; only weak signals since the 12th.'"

Thursday and Friday, December 15th and 16th, log reads as follows:

"12 Midnight—600 meter signals more abundant than usual, but considerable static; go to 200 meters, and find static much worse. However, FFU's harmonic a bit stronger than usual, and FFI in occasionally on harmonic. Been like a summer's day here, and wind blowing from east and a bit south. Up all day getting photos of set-up; also had several visitors during afternoon, and for their benefit got signals from WKQ and POZ and several others.



12:30—Static heavy and no signals.

12:45—Ditto.

1 A.M.—600 meters going strong, static bad on 200.

1:15—FFH and FFI in on harmonic. Clifden very noticeable account his absence tonight.

1:30—Now raining hard, and wind rising. Static so bad can't read FFU, which is unusual.

1:45—Static seems worse, but Poldhu's harmonic on his press schedule comes in very loud.

2:00—Static very strong on 200.

2:07—"Pace" and FFI working, also KBH working on 300 meters.

2:11—Clifden starts up.

2:15—Static so bad we shut down for a look around.

3:30—Static very heavy. No signals.

3:45—Clifden and FFU only, latter unreadable.

4:05—FFU in—readable. Nothing else.

4:11—GCC harmonics in, just readable through heavy atmospherics. Wind blowing fairly hard, and getting cold in tent.

4:30—Harmonic from some Marconi CW ship-set in, swinging badly, but loud; also GCC's harmonic.

4:35—YBV calling ZAZ; somebody calling YBV.

4:40—Static continues heavy. No signals. Weeps! Shut down. Blowing and raining like Old Harry.

5:15—Static continues to increase, and much colder, and blowing and raining hard.

5:30—FFU in, and Clifden going, also bubbles from some arc. Can't read FFU, though his signals are fairly strong, at 5:45.

6:00—Closed down. Wired Coursey: "Atmospherics, no reception."

When the original schedules were laid out, it was with a view to enabling me to complete tests and return home in time to be with my family on Christmas Day. These plans were made on the spur of the moment, and on the assumption that it would be possible for me to pack up my apparatus, get it aboard train, and reach Southampton by noon of Saturday, the 17th. After it was too late to change these plans it became obvious that such a course would be impossible, and so, before leaving London, I had booked passage on the Olympic, which sailed on the 21st. In order to catch the Olympic, pay proper respects to various men who had been of great assistance, and get my apparatus checked out by the Customs Officials in Southampton, it was necessary that I arrive in London not later than Monday.

In order to do this, it became more and more apparent that we would have to dismantle on Friday and forego the additional night of listening which should have come in according to schedule. All business houses in Glasgow close promptly at noon

on Saturday, and it would have been impossible for me to return batteries, tents, wire and other paraphernalia which we had borrowed, get my apparatus back and aboard train prior to Saturday noon. After considerable indecision, and after waiting most of Friday to see whether or not the summertime conditions which had been with us would change for more favorable ones, it was finally decided, after 3 P.M. on Friday, to dismantle. This we started to do, and by seven o'clock that evening we had everything packed and were loading it aboard a wagon. By nine o'clock everything was in Ardrossan, properly packed and labeled, and we were all set to take the first train in the morning for Glasgow.

During the night, Friday, the tail end of the cyclone which had passed across the Atlantic during our tests hit Scotland, and we were indeed happy that we had dismantled our equipment, because the winds that night were higher than at any time during our tests.

This same storm by the following morning had backed the waters in the English Channel up until the tide stood at a depth of two feet in the streets of Hull, this being the same storm which had battered the Olympic in her voyage across, resulting in the death of two men and the destruction of several thousand dollars' worth of equipment on board.

It may very well be that this storm played some part in the success of our Transatlantic Tests. Starting in the Gulf of Mexico on December 9th, the storm passed up our Atlantic Coast to Newfoundland, and then out to sea. A clipping from the London Daily Express, under date of December 20th, reads as follows:

"Cyclone breaks loose. Demon career of gales and floods. Hurricane and raging seas in the Atlantic! Tidal floods on the northeast coast of Britain, and destructive gales in Scandinavia were widely scattered. Weather phenomena that it is now possible to trace to one cyclone which swept across from America to Europe. It originated somewhere about December 9th in the Gulf of Mexico, and swept northwards out to sea, gathering in fury on its way, and then it continued its career to the northeast, and no more was heard of it until three days later. It was rediscovered on Friday evening, however, approaching from the southwest, and about 1 A.M. on Saturday morning the liner Megantic, steaming on a northerly course to pass the north of Ireland, was caught in its giant grip. It then flung eastwards, and swept across to Norway" . . . . .

Now, as it happens, all of the signals heard at Ardrossan were logged during the time when this cyclone lay between the receiving station and the United States. After it had passed to the north, no further signals were heard. Weather reports clipped from British newspapers during that period seem to give little bearing on this particular storm, although it has been admitted that the weather during the entire period was under its influence.

Some time during the test I received a

letter from London, which included the following poem:

If our climate is un-Godley,  
If the weather seem to Paul,  
If our static strikes you oddly,  
If you hear no sigs at all,  
If you get harmonics down the scale,  
As far as tuners go,  
If the dialect in Scotland,  
Doesn't sound like Ohio,  
If twenty thousand hard boiled hams  
Are waiting on your word,  
If but the thought of hearing them  
Seems very near absurd,  
If,—in the chilly morning hours,—  
The faintest sigs come thru,  
We'd like to hear about it,  
If it's all the same to you!!

I met the fellow who wrote this. His name was Harris, but his initials I don't recall. He didn't look the poet either, although he does, I believe, edit one of Britain's best popular scientific magazines called "Conquest", at which he shows even greater proficiency than at writing poems. And some chap in Belgium bravely showed his mastery of English by coming through with this:

A wise old owl lived in an oak.  
The more he saw, the less he spoke.  
The less he spoke, the more he heard.  
"Hams" should imitate that old bird.

Which I had a great notion to forward to Harris with his name substituted for the first word in the last line.

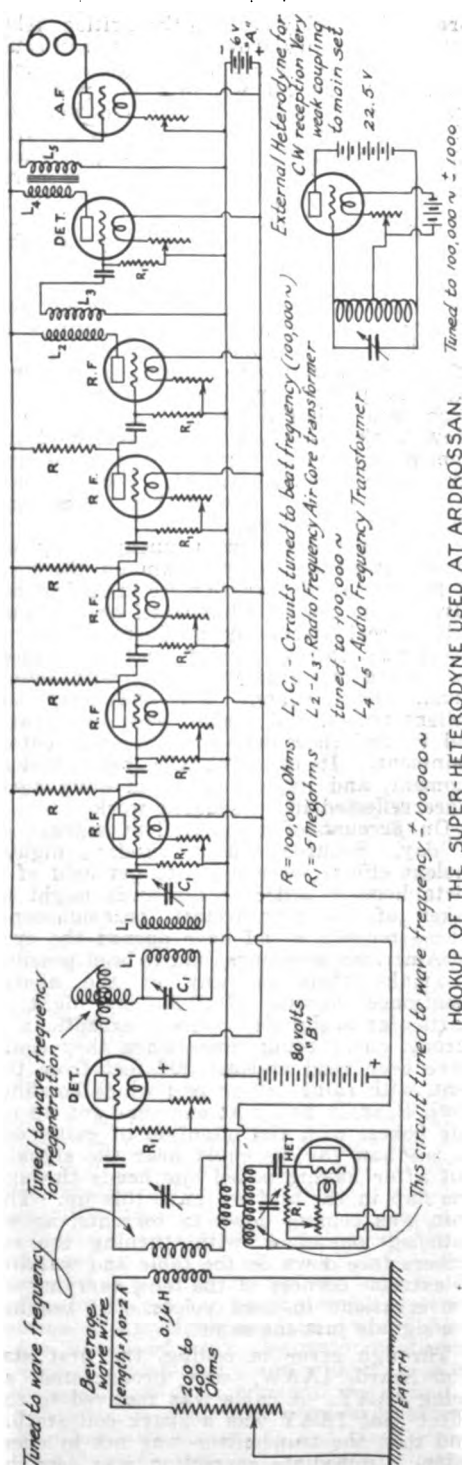
Coursey began to "ride" me a bit about this time too, with: "Aren't you sorry you didn't stay down here in the warm? Signals have been heard here on our *small aeriels*", etc., ad nauseum!! I would have enjoyed nothing more than to have had the London crowd on that seaweed-covered field.

Congratulations began to come in too, not only from England and America, but also from France when our friend Deloy showed that he was on the job by the following:

"*Hearty congratulations for your success. Here atmospherics very bad especially last night*".

Such things as this helped when we needed it. It was quite the rule to get on the job during the afternoon and find that, for some reason, several poles were flat on the ground. We were never able to ascertain whether they had been broken off by some "animal" or whether the winds had reached sufficient velocity to do it. On many occasions the wind was strong enough to bend the 2 x 4's which we used for poles several inches out of line, and their continual "working" in the soggy ground as the result of gusts probably had a great deal to do with their falling. We finally had four stays on each pole, after which no further trouble was experienced.

Prior to leaving Ardrossan, Mr. Martin of the "Ardrossan & Salt-Coats Herald" interviewed me concerning the import of the tests and their success. This interview



was followed by general publicity which pretty thoroughly covered the British Isles.

The hospitality shown at Ardrossan could not have been excelled. Everyone seemed anxious to do all within their power to make things easier for us. We were invited on two or three occasions to visit the Murchie home, which was quite near to the scene of operations, but we never had the nerve to drag our muddy selves into anyone's home again.

During one afternoon a very amiable Scotch gentleman, along with other of the town's people visited the test station. This particular gentleman possessed the enviable ability to consume large quantities of Scotch liquor. He listened during a period of several minutes to various high power stations picked up, having been told in each case "That is Berlin", and "Here is New York", etc. At the conclusion of the demonstration his remarks ran something like this: "Sall right, young man, y'understand I know a bit o'American swank when I see it."

Some real enjoyment unexpectedly included itself in our program on the next to the last night that we were in Ardrossan. Mr. Lee of the Eglinton Hotel proved himself a real friend by producing three of Scotland's fairest lassies who entertained us during one entire evening, with songs, music and dancing. All had very excellent voices, and I shall ever feel grateful toward those who provided this entertainment. It came at the psychological moment, and its effects, I am quite sure, were reflected in subsequent work.

On account of the excellent signals of Friday, Saturday and Sunday nights, violent efforts were made to get hold of a dictaphone in order that records might be taken of the transatlantic transmissions. These records would have opened the eyes of American amateurs, had it been possible to make them on any of the above-mentioned nights. On Sunday night in particular signals were exceptionally strong, there being times when they could have been read at least 300 feet from the tent, with rains falling and winds howling. Both Pearson and I at one time got up off our boxes, with the intention of going out to see how far we could hear the signals, but after having poked our heads through the flap in the tent we gave this up. The rain was coming down in torrents, so we satisfied ourselves with turning the receivers face down on the table and walking to extreme corners of the tent, carrying on conversations in loud voices, and reading the signals just the same.

Through error in coding, the first station heard, 1AAW, was broadcasted as being 1AAY. A cable was received to the effect that 1AAY was a spark coil station and that the transmitter was not in operation. Immediate correction was sent by

cable to the effect that 1AAW, not 1AAY was heard.

On reaching London, it was possible for me to go over two or three of the logs which had been handed in by British amateurs to Mr. Coursey. From these logs, and from what additional information Coursey had, it was apparent that the following stations had been heard by British amateurs: 2ZL, 1DA, 2BML, 2FP, 1AFV, 1UN, 1XM, 2ZC, and 1BCG. 1BCG was also heard in Holland, and I understand that it is reported that this station has also been copied on board ship, while the ship was at anchor in the harbor at Hamburg, Germany. A postscript on one of Mr. Coursey's letters, received during the course of the test, read as follows: "1BCG seems to be the star turn! ——— Kilowatts?"

The Holland station copied No. 1 from 1BCG complete, with the exception of the first word in the text. He was using a regenerative receiver of the American pattern, together with two stages of audio-frequency amplification. British stations were using radio-frequency amplification, and one amateur had 18 tubes in operation.

On reaching London, I had only a few hours, which I had hoped to spend in looking around, providing the fog had lifted. The fog had lifted, but I found that it would be impossible for me to pass through London without giving Coursey a complete story on the test, and to this end I spent about ten hours in his office dictating. What time was left was spent in rushing around saying good-byes to those whom I could reach, and I shall always regret that it was impossible for me to reach everyone.

The return trip on the Olympic was rather an uneventful one, except for the reception of a radiogram dated Hartford, Conn., requesting information as to date of arrival and also advising me that a reception committee would be on hand at the dock.

In due time I found myself emerging from the side of the huge ship, and fell into the arms of press correspondents, photographers and friends. Needless to say, everything was confusion, and it was with considerable relief that I presently found myself at lunch in the Pennsylvania Hotel, recounting amusing incidents to these more than welcome American "hams".

We have just finished making a real bit of radio history. What we have done means, first of all, that it now lies within our power to communicate frequently with our British cousins, provided we show the will to do so. I feel quite certain that there will be every inclination on the part of the British to co-operate to this end. I strongly urge upon those men whose transmitters showed up so well during these

(Concluded on page 46)

# EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



## This Issue of QST

**A** GAIN we have one of those queer issues of QST in which we have omitted some of our regular departments, boiled down others, and in general reduced our distributed capacity to make way for a lengthy special article. Our October number, telling the story of our First National Convention, was an issue of that kind, and this one is another.

This month we have the complete official story of our A.R.R.L. Transatlantic Tests. Strictly from the standpoint of good business in magazine publishing it would have been wiser to run the Transatlantic story in installments and make each issue of QST a well-balanced one with its usual quota of technical articles, departments, and stories. But, thank heaven, QST is not a business magazine and it belongs to us amateurs to operate in the way that serves us best and everybody is so intensely interested in the report of the tests that it has seemed by long odds best to publish the complete story in one issue even if it crowded "Calls Heard" thru the rear cover.

And so here we are, with the report on the tests in full in this issue. We will have supplementary data soon on the characteristics of the stations which got across, and there will be a more detailed report from England on the British results, and minor corrections may develop for our present story, but this is the official report of our achievement for posterity and has been checked and rechecked until we believe it is correct thruout. The reports in the press and stories in other magazines unfortunately have been conspicuous in their inaccuracies and we have been careful to make our official record an exact one.

The story of our tests is echoing around the world. Godley is famous. Our A.R.R.L. is being mentioned in the technical press of every country. We have put over a big thing, fellows, one that we can well be proud of, and one certain to prove a stepping stone to truly wonderful things in our ever-advancing hobby, Amateur Radio.

## That Hoover Cup

**T**HE glad announcement that Secretary of Commerce Hoover is going to award a cup annually to one of us amateurs appeared in the last issue of QST, along with all the particulars concerning just how the award was to be made. Secretary Hoover wants, thru our A.R.R.L., to promote individual effort and encourage design and construction of radio equipment adapted to short-wave communication. He is an engineer and fully realizes the problems that confront us, so much so that he is offering the cup to the amateur who each year produces America's best all-around home-made amateur station, with the best solution of our problems.

We must bear in mind that the Secretary is not trying to find America's "best" station but the one in which the greatest individual effort has been set forth. The fellow that makes his own is the man who wins this cup.

The conditions under which the cup will be awarded were fully outlined in the January issue of QST. Read them again carefully, then if you've made most of your apparatus yourself forward complete information on your station to A.R.R.L. Headquarters so that we may enter you in the competition. And remember that the man who doesn't forward his information can't expect to get the cup!

Our Board of Direction is naming a committee that will have charge of examining the entries and determining the winner, and an announcement will be made next month of the men who will constitute the committee.

Start right away and get all your "dope" together and see if you can't win that cup. Remember that all entries must be in this office by March 1st, 1922, for the determination of America's Best All-Around Amateur Station of 1921, the major portion of which is home-made. It will be a great honor to have that cup and be known as the station in which the greatest individual effort has been shown.

QRV here—QRQ!

# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



SINCE the story of the Transatlantic Tests really is a part of our Operating Department, we have boiled down the division reports considerably. This we can afford to do since the tests were epoch making, and too, we have division reports every month. Oh no! Brother, we do not have Transatlantic Tests every month to report. That is why we make this clear to you fellows who would be apt to ask why this and that did not appear as it was written.

We only wish to take an Armistice Day shot at those spark hounds who gradually

PULLEN BROTHERS, 5ZAB  
Houma, La.  
400 Messages.  
Delta Division.

The Central, Midwest, Dakota, and Rocky Mountain Divisions failed to send in their reports this month.

NEW ENGLAND DIVISION  
G. R. Entwistle, Mgr.

NORTHERN SECTION: A remarkable

## Message Traffic Report By Divisions—DECEMBER

| DIVISION                       | CW    |       |        | SPARK |       |        | TOTAL |       |        | % TFC | ARRL Aver. |        |
|--------------------------------|-------|-------|--------|-------|-------|--------|-------|-------|--------|-------|------------|--------|
|                                | Stns. | Msgs. | M.P.S. | Stns. | Msgs. | M.P.S. | Stns. | Msgs. | M.P.S. |       | Stns.      | M.P.S. |
| West Gulf                      | 9     | 203   | 23     | 137   | 2819  | 206    | 148   | 3022  | 24     | .269  | 248        | 12.2   |
| Delta                          | 1     | 10    | 10     | 8     | 1096  | 137    | 9     | 1106  | 123    | .099  | 96         | 11.5   |
| East Gulf                      | 9     | 436   | 48     | 11    | 316   | 29     | 20    | 752   | 38     | .067  | 81         | 9.3    |
| Northwestern                   | 0     | 0     | 0      | 9     | 582   | 72     | 9     | 582   | 72     | .052  | 148        | 4.0    |
| Roanoke                        | 10    | 402   | 40     | 3     | 58    | 19     | 13    | 460   | 35     | .041  | 182        | 2.5    |
| Pacific                        | 2     | 29    | 15     | 7     | 673   | 97     | 9     | 702   | 77     | .063  | 338        | 2.0    |
| Atlantic                       | 55    | 2773  | 50     | 16    | 778   | 48     | 71    | 3551  | 50     | .316  | 1849       | 1.9    |
| Ontario                        | 2     | 30    | 15     | 2     | 103   | 52     | 4     | 133   | 33     | .011  | 109        | 1.2    |
| New England                    | 12    | 543   | 45     | 13    | 374   | 29     | 23    | 917   | 40     | .082  | 810        | 1.1    |
|                                | 90    | 4426  | 50     | 206   | 6799  | 33     | 296   | 11225 | 38     | 1.000 | 3861       | 2.9    |
| Total Spark messages, 6799—60% |       |       |        |       |       |        |       |       |        |       |            |        |
| Total C.W. messages, 4426—40%  |       |       |        |       |       |        |       |       |        |       |            |        |

are seeing the light of CW, and who criticized us, almost unmercifully, for boosting CW. Truthfully, we were partial to CW—but why? Only because experiments and practical demonstrations showed us which path to follow. In our humblest opinion CW has established itself and we seek new fields. Those of you who have not been convinced of the worth of CW after looking over the list of stations heard across the Atlantic, need a prodding. The DX records that are being made by CW are further proof. What is needed to stabilize these DX records? We think radio frequency amplification will do it where audio has failed.

There is no question but what our traffic suffered at the expense of many hours testing the Transatlantic Tests. For the first time, the Delta Division take individual honors in traffic this month.

increase of amateur activity is prevalent in New Hampshire and Vermont which is indicated by many new ARRL stations. Activity centers around 1CHJ, 1MZ, 1AYT, 1ARY, 1APX, 1AWX, 1CM and 1FV, which stations have been handling the bulk of message traffic. Activity in Maine is represented by the good work of the following stations: 1BRQ, 1UL and 1ACO who continue to handle traffic with Canadian 9AK in Prince Edward Island, 1UL, 1BDI, 1APO who reaches out remarkably well, 1VT, and 1UQ the station of "Hot Wire" Castner, the Asst. Div. Mgr.

WESTERN SECTION: A marked increase of traffic in this section is due to the fact that more stations are reporting their work. Two new stations have made possible relaying into Northwestern Massachusetts. These are 1BEA in North Adams, Mass., and 1BUA in Williamstown, Mass.

Both stations, CW, make possible the link to Schenectady, Troy, and Albany with westbound traffic. 1COK ex-1BIS at New London offers its services for getting traffic into that city and points east. This is the first time a reliable station has been in operation in New London and we welcome it. 1BWY continues to handle traffic for Springfield although several new stations are in operation. Connecticut traffic is being handled in all directions by the following stations who have done good work in spite of the fact that the T/A Tests took up considerable time: 1RU, 1BGF, 1AW, 1ANQ, 1QP, 1ADP, 1CKI and 1TS.

The old spark at 1ZE has been sold to 1AEV who handled quite a bunch of traffic. 1ZE now consists of a 100 watt CW set. (You came to, didn't you, VN?—T. M.)

New England stations heard over the Atlantic were 1ARY, 1BCG, 1BDT, 1BGF, 1RU, 1AVF, 1BKA, 1YK and 1XM, which were reported by Mr. Godley. It is reported that British Amateurs also heard three New England stations—1AFV, 1DA, and 1UN, making a total of 12 stations getting over. 1ARY and 1BDT were heard on both spark and CW. Congratulations to you all. We thank all those who took part in the tests and were not successful and wish you better luck next time.

#### ONTARIO DIVISION

A. H. K. Russell, Mgr.

It is rumored that the Naval Department is contemplating a revision of amateur wave lengths that will exceed the American allotment. We hope it is true.

DISTRICT No. 1: 3DH has changed over to CW and is doing very good work in handling relay traffic. No reports were received from other stations.

DISTRICT No. 2: 3BA, 3PM, 3SP, and 3DS continue to handle their share of message traffic. Several improvements in the way of spark conversion to CW have been made.

DISTRICT No. 3: The only report was received from 3JL, who has been heard in Lawrence, Kans. Evidently Rogers, 3BP, has stored up for a rest after pounding away untiringly with his traffic. (Maybe the fact that he pushed everything he had into his old set to cover the Atlantic Ocean blew something in the works. Why the silence, OM?—T. M.)

#### ATLANTIC DIVISION

C. H. Stewart, Mgr.

Traffic in this division took a slump due to the time taken by the T/A Tests, but it was worth while and we can afford to let our traffic suffer for one month.

NORTHERN SECTION: 2OM, our traffic leader, was out for three weeks with a fallen mast, but is back with a higher one

and a ten watt CW set has been added. General conditions around New Jersey show an inclination toward more CW stations. Much traffic was handled by 2OM, 2ALY, 2ARB, 2BDC, 2DX, 2FC, 2BCC, 2AML, 2AQU and 2AWL. Long Island is being well represented by such good stations as 2EH, 2AJW, 2AWS, 2CY, 2BSC, 2BRS and 2FD. In Brooklyn we find the following stations always ready to take traffic and these same stations are handling the bulk of it; 2TS, 2MJ, 2ACG, 2IG, 2PF, 2FP, 2KE, 2CAN, 2RM and 2WB. 8AWP in New York State leads in traffic handling with 329 messages and 8AMZ comes second with 299. 8QM has peddled his spark set and is doing good work with ten watts of CW. C. F. Nichols of Webster, N. Y., has been appointed City Manager of Rochester and vicinity. It is rumored that 8AGK has sold his spark and is installing 500 watts of CW. Stations heard on the air handling traffic are 8ANR, 8AMB, 8MZ, 8AXQ, 8WO, and 8KU.

SOUTHERN SECTION: No report was received from Baer of the District of Columbia. Stations in Eastern Maryland are practically the same as last month while most traffic was handled by 3AHK, 3HG, 3AC, 3EM, 3UC, and 3SQ. Central Pennsylvania stations maintained their good reputation through the efforts of 8BYZ, 8HR, 8PQ who is not on the air very much, 3AQR, 8BQ who has just finished a new mast and cage antenna, 3AGT, 3BIQ, and 3DM in the South Central part. Traffic east has been going via 3AWW, 3DM and 3ZO; west via 8RQ, 8HR and 8ZAC; north via 8HR and 3AWW. 3DM and 3ZO maintain a schedule with 4EA for the south. 3AJZ is handling some traffic. 8XE is installing 500 watts of I.C.W.

Western Pennsylvania stations have been most conspicuous during the past month. 8EW operates Friday all night and from 2:00 A.M. to 4:00 A.M. on Saturday. Any one of the following stations can be relied upon for QSR and most of the traffic was handled by these same stations during the month of December: 8QC, 8PT, 8WY, 8AJT, 8EO, 8JQ, 8ACF, 8BJZ, 8AYC, 8RQT, 8BRL, 8AIO, 8EV, 8AKW, 8HY and 8LF the station of the Dist. Supt.

Eastern Pennsylvania stations have been troubled with QRM from Philadelphia making it impossible to carry on relay work before 11:00 P.M. Traffic moves north and west via 3CG and 3PU; south via 3AUW, 3GX and 3AIC. 3ZA made quite a record this month with 100 messages. Other traffic handlers are 3BG, 8ZQ and 8FW. 3ZO is the QSO station for 8UJ, 1BDI, 4CX, 4EY, 3AAN, 3BIY, 8AWP, 8ADR, 3ABI, 2EH, 2KL and numerous other stations and not the least bit of trouble should be experienced with traffic in any direction. Our old friend Rau is



QSO Canadian 3BP, 9HY, and 4GL. He keeps on the job from 1:00 A.M. to 3:00 A.M. A new station is in operation under the call 3ZV, the station of the Dist. Supt.

#### ROANOKE DIVISION

W. T. Gravely, Mgr.

Reported by 3MO

Even though the Transatlantic Tests bid fair to break up our traffic, the sign, "business going on as usual" was hung out in this division.

VIRGINIA: While 8SP leads in message traffic, good work was done by 3CA, 3RF, 3BIY, 3APA, 8EF, and 3AOV. 8BDB wanted more amperes in the antenna and in his anxiety blew up his condenser and transformer. Hard luck, OM.

NORTH CAROLINA: Bunker and White failed to report. XF1, whose call has been changed temporarily to DF1 awaiting assignment of a three letter call, handled most of the traffic and this station has proved its value to the division. 4EN and 3BZ maintain a daylight schedule as does 4DQ with 4CX. 4GX is again ready for work. No reports were received from 4EA and 4EY. (4EA came through every night during the T/A's extremely QSA in Hartford—T.M.)

The trend of all stations is to CW. Probably being so close to the East Gulf Division which is commonly and rightfully dubbed the "CW Division" this division feels the need of more CW stations.

The entire "gang" is going to the 3rd and 4th districts convention where many faces will be seen and many hands will be shaken.

#### EAST GULF DIVISION

B. W. Benning, Mgr.

A club in Montgomery is formed for the purpose of controlling QRM in the Alabama District. We need help in the southern part of Alabama! Also, we need a live wire City Manager for the city of Birmingham. Applications are in order. 5ON is out of commission because of condenser trouble. 5XA is doing practically all of the relay work for this section, working eastern stations direct, which was not the case a year ago.

GEORGIA: Savannah stations lead in traffic work with those excellent CW stations of 4GL, 4BY, 4EL and 4GE. One points with pride to the fact that the above four named stations work consistently and reliably without interference which was not the case with spark stations. 4DH will act as intermediate relay between Atlanta and Macon. 4DT, 4DY, 4GN, 4FD, 4AS, 4BK, 4GU, 4JH, and 4BW are also handling their share of traffic and what is more they are reporting it properly. In Atlanta we find excellent means of communication

through stations 4CO, 4XC, 4ZF, 4AU, 4CG, 4HW, 4FJ, 4YA, and 4GM. It is reported that 41 other stations are not interested in relay work. How come?

SOUTH CAROLINA: 4IB, the station of East Gulf's Y.L., is ready for business and don't fool yourself if you tell her to speed up and find that she can handle traffic at 35 W.P.M. We welcome you Miss ———? Another station on which we have no report is 4HR. New stations in Greenwood and Spartanburg will be in operation by the time this appears in print. 4EG must move his tin roof before he can hope to reach out. The tin roof seems to affect his antenna efficiency.

FLORIDA: 4ZE assisted by 4BP and 4JK, is accepting traffic for Jacksonville while 4AW, 4DL and 4BO take care of West Palm Beach. 4II is so busy organizing Florida stations that he is limited in his operating hours, hence no report from him, but we know that he is on the job.

#### DELTA DIVISION

J. M. Clayton, Mgr.

The past month has been a record one for this division and radio seems to have taken a new lease on life. Practically all of the old timers are back stronger than ever and their good work is appreciated. The most representative report was received by the Division Manager for which he wishes to extend his thanks. (Keep up the good work, fellows—T. M.)

TENNESSEE: 5MB with CW is ready for traffic for Chattanooga. Schedules for control of traffic were put into effect by the Nashville Radio Club which club boasts no deadheads. Guess 5CU is spending his time listening to KDKA. We haven't heard a peep from him. 5DA, 5ER and 5FV continue to move traffic. We want some light from Memphis. Is there anyone alive in that burg? If so please come forward and get in touch with the Division Manager.

ARKANSAS: Mr. Kinsolving has been appointed District Supt. of Arkansas. R. L. White, formerly of West Gulf, is with us and we welcome his coming. 5JD is getting to be a regular boiled-owl and is more than moving his share of messages. Other good relay work is being done by 5RO; 5SM, 5AK operator. Prospects look bright for 5JF and 5CR who have good stations but have not reached out as yet.

LOUISIANA: 5ZAB deserves much credit for clearing 400 messages during the month. (FB—T.M.) 5KC clipped off a bunch too. 5AA bears the brunt of traffic at New Orleans in spite of QRM from WNU and NAT. Old boy DeBen can stop right along wid any of them.

MISSISSIPPI: 5YE is not in operation due to unavoidable circumstances, but promises to be on the air very shortly. We

are waiting for you and need you badly. Hurry up.

### WEST GULF DIVISION F. M. Corlett, Mgr.

With the exception of a report from New Mexico Section every one was in on time and the Division Manager wishes to express his thanks for the co-operation. A glance at the traffic report will show that many stations reported and a record breaking amount of traffic was handled.

**SOUTH TEXAS SECTION:** Due to decrease in QRN, traffic conditions have improved. Another feature is that practically all hands are turning to CW because of the demonstration it gave in the T/A Tests. Mr. H. C. Sundstrom has been appointed City Manager of Houston. Mr. L. W. Hatry has been appointed Asst. Dist. Supt. for the territory of Port Arthur. 5ZU, 5XU, 5ZAG, 5QY and 5QA keep the district in the limelight. San Antonio remains in the hit-and-miss class thus far. In the southwest 5ZAK remains the star and has been handling most of the traffic. 5ZR, 5HC, 5ZAE and 5XI have been handicapped for some reason or another. In Laredo 5MT on CW is moving traffic. 5ZN is doing more receiving than transmitting for the present because of business pressure.

**OKLAHOMA SECTION:** Too much cannot be said about the good work done by ex Asst. Div. Mgr. Dill who has left for U. of Wisconsin. In addition to supplying QST with good reports old 5HC has been on the air regularly and always QRV. Considerable amount of traffic was moved by 5HK, 5JR, 5FO, 5BY and 5AQ. Improvements have been made in one way or another in the following stations who can be looked upon for reliability: 5JT, 5EF, 5NA, 5KE, 5BM, 5LO is credited with 301 messages for the month, which speaks well for that station.

**NORTH TEXAS SECTION:** Reports are lacking from Wichita Falls, Vernon, Quanah, Henrietta, Montague, Graham, Jacksonboro, Weatherford, Mineral Wells, Albany, Baird, Gatesville, Lampasas and Ballinger. City Managers are needed for the above towns and the Division Manager will be glad to communicate with amateurs in those places. No report has been received from 5YN. 5QQ, 5NS, and 5FI are doing good relay work for the League. 5AO is making changes for the better in equipment. 5RP with his spark coil is moving traffic in commendable style. 5LY is installing a large transmitter for real DX work. Nothing heard from 5OH nor 5OK. 'Smatter, fellows? Three stations in Dublin have reached California the past month, 5IR, 5QS, and 5XJ. We hear 5QT and 5UG quite often moving messages. 5ZAF

seems to be the only station in Waco working DX. Ft. Worth is represented by 5QI, and 5LC. 5PE is afflicted with CQ-itis and would move traffic if he would cut out his CQing occasionally. 5ZAM, 5TU, and 5IU in Commerce are all good relay stations pushing messages hither and yon. The motor at 5IU went catawampus and is being repaired. In the meantime 5ZM is on the job.

### NORTHWESTERN DIVISION H. F. Mason, Mgr.

**EASTERN SECTION:** QRN is unusually slow in QRTing this season, but in spite of it commendable relaying is being done by 7ZU, 7ZG who has been bothered with power troubles, etc., and 7MP who keeps all night watch. Nothing heard from 7EX. Some assistance is needed from Helena, Mont., will someone please lend a fist? 7LY has been out due to a sick Benwood. 7LY works 9AGN in daylight with ease. A new station at Libby, Mont., is 7VZ who is QSO Seattle.

**OREGON:** 7ZT with his old sideswiper knocks out traffic with amazing speed along with 7KB, 7JW and 7ZJ. 7TJ, who has taken the place of 7IN, is making good. 7MF continues to come roaring through the QRM.

**WASHINGTON:** 7BK and 7ZS report that 7FI has been handling the bulk of traffic with 7NL next in line, who has been assisted by 7YL. School press is also sent from 7YL. Practically all of the eastbound traffic goes thru these stations, including 7YA, 7ZP, 7YS, 7BA, 7BC, and 7BG continue to clear traffic with equal regularity from Tacoma, and Seattle traffic is cleared by 7BF, 7LD, 7PO and 7BK. Traffic for the south goes through 6QR and 6VX, who are most consistent.

ARRL stations are playing an important role in the relaying of school news and press service at present, which consists of about 300 words per week.

### ALASKAN DIVISION Roy Anderson, Mgr.

7IP reports hearing more signals from the States and it looks like it may be a good scheme to try broadcasting messages into Alaska. The following stations are reported: 7MT, 6ANF, 6IK, 7XA, 6APE, 7BJ, 7JW, 7LJ, 7BK, 7MX, 7BS, 7KB, 7KS, 7HF, and 7XF. We suggest that the above stations attempt to broadcast messages for Alaska.

### VANCOUVER DIVISION Roy Anderson, Acting Mgr.

Canadian 4CB was heard by Canadian 5CZ of Vancouver and it is the first time that a Canadian amateur signal has passed

over the Rockies. It is reported that 4CB uses ten watts of CW. Mr. Wood's name has been recommended for consideration as manager of this division and since we are looking for a good man the T.M. requests further information from Mr. Wood. We can find places for several good live amateurs. Mr. Anderson has done much towards a Vancouver Division, but has his own to look after and still more and we would like to have a man on the ground.

### PACIFIC DIVISION

J. V. Wise, Mgr.

Radio activity in this division is partly covered in this first report of the new Division Manager. At this early date it is rather a difficult proposition to gather more than a mere glimpse of what we are doing. Mr. H. L. Gooding, of Douglas, Ariz., has been appointed Superintendent of Arizona which is known as District A. District B includes the counties of San Diego, Orange, Imperial, and San Bernadino in California, of which Mr. J. F. Gray of Del Mar is Superintendent. District C under Mr. B. H. Dennis of San Fernando, Calif., has not been outlined as yet. Next month the complete outline will be given of those districts not mentioned here.

Stations north of Los Angeles who are heard handling relay traffic every night are 6AS, 6EX, 6HC, and 6HP. In the Sacramento and San Joaquin Valleys we find traffic being moved by the following stations: 6AK, 6KM, 6GF, 6FH, and 6ZX, with 6AFV and 6LU further north. In the vicinity of Fresno we find 6ALE on CW and 6ZU on spark always ready to QSR. A number of excellent stations in San Francisco and down the coast have not been heard from, but we will have more details in the next report.

6QR is about the only station in Nevada at this writing who is heard consistently. 6ZZ in Douglas, Ariz., continues to bat them out on both spark and CW.

Stations in and around San Diego are continually hampered in relay work by the mush from NPL, altho there are dozens doing the best they can through it. 6AJH had the misfortune, after he had climbed to the top of his mast, to fall with it, resulting in serious injury. 6AJH will be missed while he is recuperating.

Los Angeles will have a complete report next month. Come on, all of you. Let's show them that West Coast Amateurs in the Pacific Division are on the job.

### OFFICIAL RECEPTION REPORT

(Concluded from page 40)

tests, to arrange for additional tests in conjunction with British amateurs, and as far as I am able to learn it will be possible

at no distant date for British amateurs to transmit on 180 meters, signals which should have a good chance of reaching this side.

The part which British amateurs have played in the tests just completed has accomplished far more in the way of the creation of enthusiasm for this sort of thing than anything else could possibly have accomplished. It has been pointed out to them that American amateurs—all stations—are transmitting every night, day in and day out, and that what the British heard during the week of the test, they may hear again and again throughout the coming season, provided they listen with sufficient patience,—and, what is most significant, that some of the stations heard from in America were using an output of but 30 watts.

It is quite a common thing to read in the British daily papers of such, to them, unusual procedures as the broadcasting by radio-telephony of "The Evening Hour Story for Children by the Man in the Moon," or "A Wireless Church with an audience of 20,000 to 30,000 people," or "Grand operas which are available to any who care to listen."

*Is it hopeless to expect that sooner or later Europe will follow with similar programs? Would it not be foolish to presume that Europe can much longer remain blind to the advantages of such programs?*

At any rate, American amateurs are watching the progress of our British contemporaries with an interest which is far more real than it has ever been in the past. British amateurs have proven their mettle and there are a great many of them now ready to be welcomed into the great order of the "Hard-Boiled Ham."

## ANOTHER TRANSATLANTIC

As we go to press word reaches us that F. Clifford Estey's station at Salem, Mass., 1AFV, described in January QST, succeeded in the second week of January in passing three messages in a row to W. W. Burnham at London. Mr. Burnham acknowledging them by cable.

Already our Transatlantic Tests are bearing fruit. Let us hope that very soon Transatlantic Traffic Schedules can be established.

# Who's Who in AMATEUR WIRELESS



**Bob Trump**

No one anywhere in the Mississippi Valley will have the least difficulty in remembering old 9JW of pre-war days. When the late ones were thinning out 9JW was coming on for the routine business of taking them from Ohio and passing them to old 6DM at Phoenix, Arizona.

Robert Kitts Trump was born July 14, 1898, in Topeka, Kansas, where he resided until the fall of 1918 when he enlisted in the Navy and was sent to Cleveland for service. Later on he was transferred to the Great Lakes Hospital because of illness which resulted in the loss of his voice, which he has not recovered. He was sent to Arizona where he remained until 1919, and then returned to Topeka. Recently he has moved to Ottawa, Kansas, where he plans to stay if the power line induction doesn't get too bad.

Trump began at the age of ten to learn

*(Concluded on page 55)*



**Robert C. Higgy**

Bob was born December 7th, 1902, at Columbus, Ohio, and when ten years old his folks moved to Lima where his radio activities were first begun. Early in 1912, 8PM was put in operation with the usual spark coil transmitter which gradually grew to be a full kilowatt, covering the customary long distance ranges of those good old days.

In March of 1915 he moved west, finally locating in Phoenix, Arizona, where old reliable 6DM was put in operation and many records made which to this day are not to be laughed at. There are not many stations today that can boast of being heard in every state west of the Mississippi and as far east as Ohio. 6DM was the missing link between the Pacific Coast and the East in its early days and had the honor of handling the first messages from one coast to the other on the old A.R.R.L.

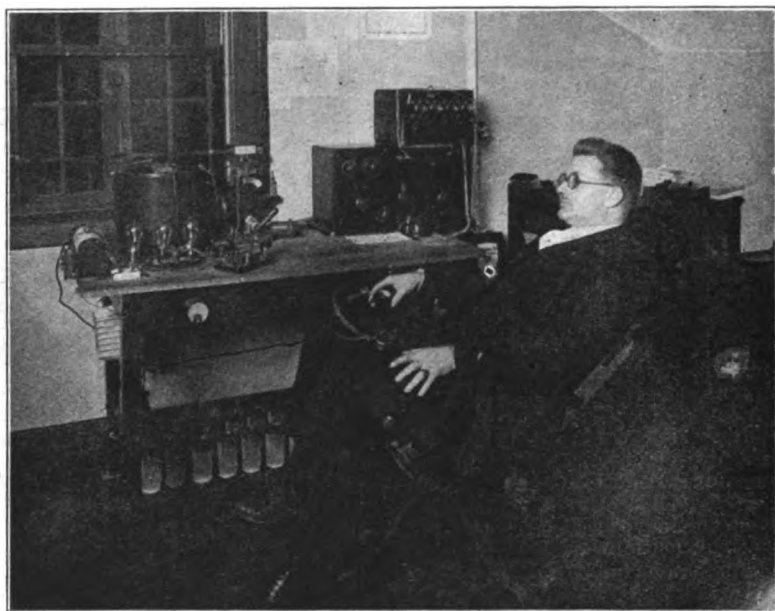
*(Concluded on page 55)*



# Amateur Radio Stations



*4GL, Savannah, Ga.*



Here is O.M. F. A. Hill and his wicked bug with which he is wont to murder the ether nightly at about 40 per. Mr. Hill did not send us any detailed description of his station and we suppose he thinks that the noise it makes is sufficient introduction. 4GL has made a wonderful name for itself in the last few months, handling traffic consistently over great distances and being reported inland to North Dakota and 2450 miles east at sea, which is almost to England. All of this work has been done on the output of three so-called 5-watt tubes. We don't know their actual output but imagine it is around 50 watts. The circuit is the now famous British air-craft circuit that is giving such excellent results among our amateurs, and the general arrangement of the apparatus will speak for itself. The

anode supply is rectified A.C.; the electrolytic rectifier being seen on the floor beneath the operating table.

The receiver seems to be a modified Marconi type 106 but perhaps Mr. Hill is only using the panel because it is pretty and has some really efficient equipment behind it. The tube equipment consists of a home-made detector and three step.

Mr. Hill is a real operator and it is a pleasure to hear him clipping off traffic every night at high speed. His signals seem to reach out well in all directions but in particular he has solved a nasty traffic situation by establishing perfectly reliable communication with 3ZY, also CW, in Washington, bridging a gap that for a long time prevented the efficient disposition of Washington traffic destined south.

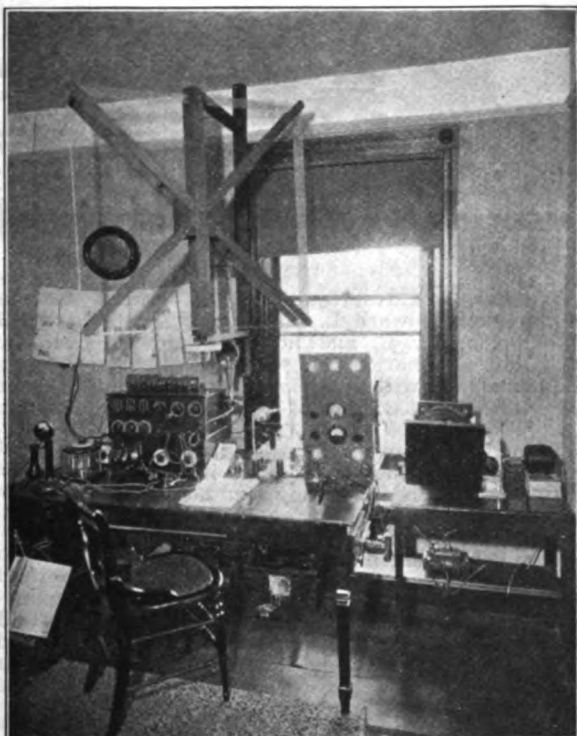
## 2BB, Ossining, N. Y.

Mr. I. R. Lounsberry's station is considered one of the old timers along the Hudson River Route of the A.R.R.L. and consistently handles traffic during the operating season.

Both spark and CW are used. The spark set consists of a  $\frac{1}{2}$  K.W. Packard transformer, Dubilier condenser, Benwood gap, and a Clapp-Eastham oscillation transformer, giving an antenna current of 3.5 amperes. The CW set is a standard direct-coupled circuit using a 50 watt Singer tube with rectified A.C. on the anode, with an antenna current of 1.25 amperes.

Tuning is accomplished by means of honeycomb coils loaded by series variometers. On higher waves the variometers are shorted and tuning is done with condensers. Mr. Lounsberry has found this very effective in short wave CW work.

The aerial is a "T" type of six wires, 60 ft. high, and a total flat-top length of 60 ft. Ground connection is made to water pipes and a chicken wire fence which parallels the aerial. The main purpose of the loop shown in the photo is to work duplex with 2XX, but it has also been



found surprisingly effective for handling regular DX traffic.

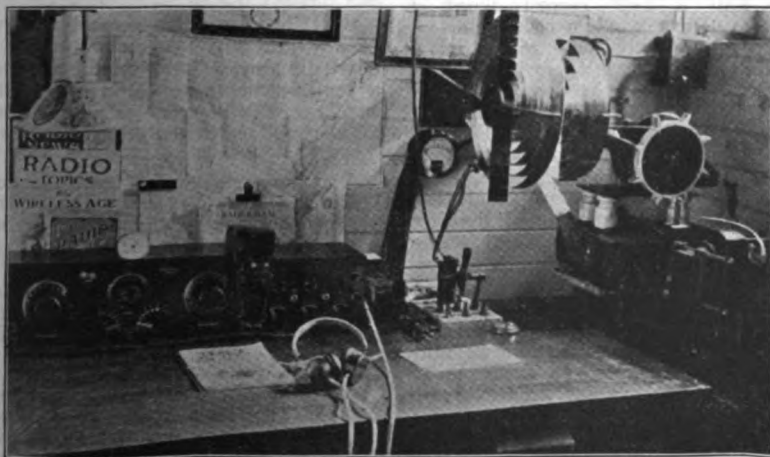
## 2WM, Ridgewood, L. I.

2WM belongs to William Leyh and is located at Ridgewood, L. I.

The antenna is a slanting fan, supported between two masts. The one at the open


end is 60 ft. high and carries a 24 ft. spreader which supports five stranded wires, which run in one piece without joints from this mast to the apparatus, a distance of 120 feet. The inner mast is 40 ft. high

(Concluded on page 51)





# Strays



We have lost from our A.R.R.L. Board of Direction Howard L. Stanley, 2FS, late of Babylon, L. I., and now of Caldwell, N. J., his resignation being made necessary in accordance with our Constitution when he entered the employ of Adams-Morgan Co.

Stanley was our shark on English, a man with an inborn horror of split infinitives, sentences couched entirely in negatives, and general loose language, and many a complex resolution or motion on the records of our Board meetings is the handicraft of Brother Stanley.

We are sorry to lose him but our good wishes are with him always, for he will ever be an A.R.R.L. booster.

## A New DX Record

8LF of Crafton, Pa., reported from Avalon, Calif., on April 19th on an antenna power of 46 watts (yes, C.W.), has just doubled that distance. On the night of Nov. 6th last his sigs were copied 2750 miles west of San Francisco by G. C. Farmer, operator S.S. "West Prospect", KDUK, as reported in a service message to operator of KBEQ and mailed to Crafton upon arrival in port. Reported information checks with log of station 8LF.

All a hail a new record—what seems to be a new world's record for amateur DX—roughly 5500 miles on 46 watts!

The Diamond State Fibre Co. of Bridgeport, Pa., developers of the well-known insulating material Condensite Celoron, have established at their plant a radio station and laboratory for the purpose of making all kinds of tests upon their products. The station consists of a 1 K.W. spark transmitter, as well as a 300 watt C.W. and phone transmitter consisting of six 50-watt Radiotrons. This station is working on a regular schedule with other amateur stations. The company is also endeavoring to co-operate with the radio amateur by assisting in working out his experimental problems for him, and furnishing him with

technical information as he may desire.

Condensite Celoron is a homogeneous compound of Condensite, one of the best insulators known, and fibre; a combination is produced which makes a very desirable insulator for radio panel work.

Westinghouse have a new detector tube designed with a special base for use in their new concert-receiving sets. The interesting feature is that the filament requires a potential of but 1.1 volt, drawing 0.2 amp., or less than  $\frac{1}{4}$  watt. This means that a single dry cell will operate it for many hours, and makes it especially valuable for portable sets.

Incidentally, a full line of Westinghouse receiving tubes for general amateur work is expected on the market soon.

## Wouldn't It Be Wonderful—

If antenna insulators wouldn't pull loose?  
If waterpipes made good ground connections?

If 4GL would clip about 20 w.p.m. off his speed?

If the trolley companies would let us tap their lines and have all the juice we wanted?

If our call books were up to date?

If the QRM babies were really tied to the North Pole?

If 6DA would not look at the "picture on the wall" when he started to transmit.

3ZO has a return postcard which he mails out with received msgs for acknowledgment. On one side of the card is a regular message blank and on the return card there is a message receipt blank to be signed and returned by the addressee.

We have heard of quite a number of stations lately that have made attempts to operate on waves as low as 100 meters but can't find anyone that is listening that low. 9ZT reports he can get over an ampere CW on 125 meters and wants someone interested in working on that wave to listen for him. Just think of the possibilities of such a wave! Not a bit of QRM from the old rock-crushers.

The June, 1921, issue of the Department of Commerce's "Amateur Radio Stations of

the United States", is now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at fifteen cents. Stamps are not accepted. It contains 203 pages of amateur calls, differing somewhat from the previous issues in that the station owner's name and address is included in the alphabetical list of calls instead of listing the addresses in the alphabetical list of station owners' names. It is good to have a complete call-book again.

A wild rumor is floating around that Armstrong has a new receiving scheme that does everything that the super-heterodyne does but uses only one tube. The reports have it that the amplification obtained on phone signals is 100,000 times that of an ordinary regenerative set, and that it is a cool million times better on telegraph signals. "Super-regeneration" of some sort seems to be the idea.

We await further particulars with what patience we can muster.

Amrad recently offered several prizes in a contest for a name for their new variometers. Munroe Cox, 1CJR of Swampscott, Mass., took the first prize, suggesting the name "Basketball Variometer".

Johnny Reinartz, 1QP, tells us that he used some real macaroni for "spaghetti" in one of his receivers and the mice cleaned it out one nite. Feed 'em rubber, John.

Ham ham ham, Jam jam jam,

Q R M

Wt the hx is the matter wid 'em,  
They sit on the key and hold it there,  
Wud make all the angels in heaven swear,  
Ham! Jam!

Q R M!

Read 'Em and Weep!

8LX of Crafton, Pa., worked 6XAD Avalon, Santa Catalina Island, Calif., for twelve minutes on the morning of December 10th.

8ML, Murphy of Cleveland, using two 5-watt tubes, was copied in Long Beach, Calif., by 6ALP.

The radio telephone of the Radio Shop of San Jose, Calif., was heard by W. E. Long of Sterling, Illinois. Two fifty-watters were used at San Jose.

Mr. Wesley Robinson, Jr., of St. Marys, Ga., reports hearing the Long Beach-Avalon phone regularly. First time we've heard of its direct reception in the east.

Mix, 1TS of Bristol, Conn., has heard the CW at 6WV, Fresno, Calif.

Mr. H. S. Shaw, the author of "Some Comments On the Sure Fire C.W. Circuit" appearing in the January issue of QST, requests that the following be added to

the third paragraph from the end, following the words "should be very small"; "In fact, if the antenna resistance is not too high, and the coupling of grid and plate is right, the tuning condenser may be dispensed with entirely, thus eliminating the only really critical adjustment in the whole circuit."

The Telephone Companies have agreed in the future not to place the usual "Property of the Wah-Hoo Tel. Co." on their transmitters, as they claim that it often causes the embarrassment of an honest C.W. man.

Scientific Paper No. 423 of the Bureau of Standards entitled "Operation of the Modulator Tube in Radio Telephone Sets" contains much valuable information that will be of use to the phone man. It is an excellent paper by E. S. Purington, Assistant Physicist, and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for ten cents (stamps not accepted.)

Another recent Bureau publication that contains much interesting information is the "War Work of the Bureau of Standards," Miscellaneous Publication No. 46. It contains considerable radio matter relative to the development of apparatus for military purposes and new methods of making radio measurements. It also may be secured from the Superintendent of Documents, for seventy cents.

## 2WM, RIDGEWOOD, L. I.

(Concluded from page 49)

and on its 8 ft. spreader carries five large wooden pulleys, 5" in diameter, into which the wires of the fan are set in order to eliminate sharp bends and avoid extra connections. From this spreader the five wires go direct to the apparatus which is located in the basement 5' below the ground. The earth connection consists of water pipes and other buried pipes under the antenna, with separate leads which have been tuned onto the oscillation transformer to correct phase differences.

The transmitter consists of an Acme 1-kilowatt transformer, home-made synchronous and non-synchronous gaps, and a home-made condenser of .006 mfd. capacity. This condenser consists of 16 glass plates, 10" x 16" x 1/4", with copper sheeting for the electrodes, the whole immersed in boiled linseed oil. The oscillation transformer has for its primary four turns of 3" ribbon and for its secondary seven turns of 2" ribbon, all mounted on bakelite. The apparatus is arranged for short leads, the longest being 6". Antenna current on a Jewell thermo-couple meter is 4 1/4 amperes and the decrement is 1.8.

# Calls Heard



## HEARD DURING DECEMBER Unless Otherwise Specified.

### SIGNALS HEARD IN HAWAII

Along with the good news of our transatlantic tests comes word that signals from west coast stations have been heard by Clifford J. Dow, 6ZAC at Wailuku, Maui, Hawaii. Mr. Dow will have a CW transmitter going shortly and then for a relay to China!

The following stations have been heard by Mr. Dow.

Hawaii Time Dec. 19th.  
6:22 p.m.—CQ de 5QA  
6:49 p.m.—7YG de 7YA  
6:50 p.m.—6XAC de 6ZAF  
7:52 p.m.—6ZX de 6ZB

Dec. 20th.  
7:05 p.m.—6KA de 6ZB  
7:16 p.m.—9NX de 9GK  
7:25 p.m.—7NY de 7YG  
7:25 p.m.—9AGN de 7ZU  
7:27 p.m.—7YL de 7YG  
7:35 p.m.—9AGN de 7ZU  
7:45 p.m.—6UQ de 6ZE

Hawaiian time is two and a half hours earlier than San Francisco time.

### HEARD AT SEA BY "NV."

Dec. 5th. 35 miles south N. Y.—1AHL, 1ABY, 1APO, 1YD, 1XM, 1BFX, 1AW, 1BVB, 1FV, 2KL, 2DK, (plenty 2's in) (also plenty 3's not logged), 4EA, 4YA, 8AFG, 8AMZ, 8BVA, 8AXN, 8AFA, 8XE, 8RQ, 8XVA, 8FI, 8FT, 8WO, 8ZAC, 9MC, 9HR, 9TL, 9AWX, 9DLX, 9YAC, 9AWZ, 9AEK, 9ME, 9JN, 9DF, Dec. 6th. 150 mi. south N. Y.—1ARY, 1APO, 1ST, 1BIR, 1RV, 2AJW, 2DX, 2DK, 2DN, 2ARK, 2TS, 2AIM, 2BY, 2FP, 3XM, 3XF, 3AKR, 3ARM, 3AHK, 3AMZ, 3BVA, 3AMB, 3XN, 3TK, 3AHU, 3XE, 3NO, 3JL, 3DLX, 3GX, 3UH, 3ACB, 3AMA, 3MC, 3ASJ, 3ZJ, 3AAP, 3IE, 4GN, 4BY, Dec. 7th. 465 mi. south N. Y.—1APO, 1XM, 1BCG, 2AID, 2DA, 2JU, 2EL, 2TJ, 3AGT, 3AIG, 3DH, 3AQR, 3AHK, 3BP Can., 4FD, 5FV, 5XA, 5ZAB, 5XU, 5DA, W2 CW, 8BVA, 8AMZ, 8AHU, 8APB, 8XM, 9DWP, 9ASJ, 9ME, 9AWZ, 9TL, 9JN, 9DZE, Dec. 8th. 660 mi. south N. Y.—1XM, 1UN, 1BGF, 1BCG, 2AWF, 2XK, 3BP Can. 3AHK, 3AC, 4CG, 4EL, 4EA, 4GL, 4FD, 4BY, 5EK, 5XB, 5ZAK, 5NC, 5ZL, 5IR, 5QS, 5XA, 5HK, 5BVA, 5ZY, 5EF, 5XE, 5ZU, 5BK, 5RQ, 5ZG, 9AMA, 9TL, 9AAW, 9MC, 9DWP, 9HR, 9ASJ, 9ZJ, Dec. 9th. 950 mi. south N. Y.—1BCG, 1AEV, 2AWL, 2BRB, 2FP, 2AIM, 3TH, 3AHK, 4EA, 4AU, 4FD, 4BY, 4GN, 5DA, 5ZAB, 5XA, 5FV, 5HK, 5EF, 5XE, 5SP, 9OX, Dec. 10th. 40 mi. west Key West—1BCG, 2FP, 4GL, 4EL, Dec. 11th. 175 mi. west Key West—1BCG, 1RU, 2FP very QSA, 2EL, 2ZL, 4EA, 4FD, 4DH, 4AU, 4AS, 4GL, 4GN, 4BQ, 5ZAM, 5IQ, 5HK, 5ZAB, 5IS, 5KC, 5QS, 5XA, 5ARY, 9AMA, 9ASJ, 9SY, 9LF, 9AMS, 9DQ, Dec. 12th. 350 mi. East Sabine, Texas—2FP, 4BY, 4BQ, 4GL, 4YA, 5ZD, 5YI, 5BY, 5IR, 9MC, 9NX, 9DQ, 9DPH, 9AEG, 9AMA, Dec. 13th. 125 mi. east Sabine, Texas—2FP, 4GL, 4BY, 4BQ, 5ZAB, 5XU,

5ZE, 9YM, 9WT, 9NX, 9MC, 9AEK, 9ARI, 9ANF, 9MC.

Can. 5BX, Vancouver, B. C.  
CW: 1BCG, 6VA, 6JX, 6XAC, 6XAD, 6ZED, 7RN, 8LX, Can. 4CB.  
Spark: 6ACB, 6AIF, 6AMK, 6APE, 6EB, 6KM, 6Z, 6ZU, 6ZX, 7BA, 7BG, 7BH, 7BJ, 7BK, 7BR, 7CW, 7CZ, 7GE, 7HF, 7IN, 7JW, 7KB, 7KJ, 7LY, 7MF, 7NG, 7NL, 7VZ, 7ZS, 7ZT, 9HI.

Can. 3MR, Toronto, Ont.  
Spark: 1AW, 1FF, 1GM, 1HK, 1NB, 1SN, 1XM, 1AAW, 1APO, 1ARM, 1AVI, 1AWO, 1AYL, 1AZK, 1BCX, 1BEA, 1CHJ, 2EH, 2EL, 2HG, 2KL, 2OM, 2PL, 2VA, 2XK, 2XQ, 2ZR, 2ACM, 2AER, 2AID, 2ARM, 2AWH, 2AWL, 2BRB, 2CCL, 2EAA, 3BG, 3CG, 3DH, 3HJ, 3NB, 3UQ, 3YV, 3ZO, 3ZV, 3ADT, 3AFK, 3AHF, 3ASU, 3AUW, 3BKQ, 3CCZ, 4BY, 4CK, 4CO, 4CS, 4EA, 4HT, 4XC, 5DO, 5EK, 5XA, 5XK, 5ZZ, 8AG, 8BO, 8BU, 8BY, 8CF, 8DR, 8EB, 8EL, 8EV, 8YC, 8KJ, 8LH, 8NB, 8NO, 8OI, 8SP, 8SZ, 8TT, 8VC, 8VW, 8WE, 8XC, 8XK, 8YN, 8ACZ, 8ADR, 8AHH, 8AJN, 8AMQ, 8AMZ, 8ARD, 8ASZ, 8AWB, 8AWX, 8AXN, 8AXQ, 8AYC, 8AYE, 8BFX, 8BKO, 8BRL, 8YAA, 8ZAC, 9AG, 9AM, 9AU, 9DQ, 9DR, 9DW, 9DY, 9GO, 9HR, 9KG, 9LF, 9LN, 9ME, 9TL, 9WT, 9XJ, 9YY, 9ZN, 9AAW, 9ACB, 9ACY, 9AGR, 9AIR, 9AWX, 9AZV, 9BDS, 9BLO, 9DIX, 9DRX, 9DWP, 9DXM, 9DYC, 9ZAC.  
CW: 1FF, 1OK, 1PD, 1QN, 1RH, 1RU, 1SZ, 1UN, 1WR, 1XJ, 1ZE, 1AMQ, 1ANY, 1AWP, 1AXI, 1BCA, 1BXG, 1BEA, 1BEP, 1BKA, 1BKQ, 1BWJ, 1CAK, 1CDR, 1DWJ, 1XQO, 2EL, 2FD, 2GB, 2GK, 2NN, 2NQ, 2QB, 2QG, 2QR, 2TK, 2UD, 2XQ, 2AAB, 2ADT, 2AEQ, 2AFV, 2AGB, 2AJF, 2AJU, 2AJW, 2ALR, 2ANZ, 2AUU, 2AWF, 2AWL, 2AYI, 2BEB, 2BFS, 2BFZ, 2BGH, 2BMR, 2BQT, 2BRB, 2BRG, 2BSC, 2BVE, 2BVS, 3FR, 3FS, 3MO, 3PN, 3AET, 3AJB, 3BEC, 3BHL, 4TD, 4IZ, 4ZF, 8BO, 8HJ, 8HW, 8IL, 8IQ, 8IV, 8JL, 8JQ, 8KH, 8KM, 8KS, 8LS, 8ML, 8NB, 8NM, 8NT, 8OW, 8UJ, 8UZ, 8WR, 8XK, 8XV, 8ZN, 8ZV, 8AAV, 8ABO, 8ADA, 8ADB, 8AFE, 8AHR, 8AIL, 8AIO, 8AKD, 8AMM, 8AMV, 8ANO, 8ANP, 8ATN, 8AXC, 8BFH, 8BFX, 8BLR, 8BMA, 8BOZ, 8BPX, 8BRL, 8BUJ, 8CBR, 8BQD, 8BMM, 8BQV, 8NAV, 9BL, 9FM, 9FZ, 9LQ, 9NX, 9WC, 9ZB, 9AAT, 9AJR, 9AKD, 9AKN, 9ARK, 9BED.

Can. 4BD, Winnipeg, Man.  
Spark: 4BZ, 5HK, 5KM, 5XU, 8AC, 8BZY, 8YN, 8ZZ, 9ACG, 9ACN, 9AEG, 9AEY, 9AIF, 9AIG, 9AIR, 9AQC, 9ARZ, 9AVN, 9AYV, 9AXE, 9BLO, 9DKQ, 9DWP, 9XAM, 9XAB, 9YAC, 9YAE, 9YAK, 9EE, 9EK, 9HA, 9HM, 9JN, 9LM, 9MC, 9ME, 9MK, 9MO, 9NR, 9PS, 9TL, 9UU, 9WA, 9WI, 9WU, 9XI, 9ZC, 9ZJ.  
CW: 1BCG, 4BQ, 4BY, 5ZA, 7HS, 7ZK, 7ZM, 8ABO, 8BK, 8XJ, 8ZG, 9AGN, 9AJA, 9AKR, 9AMB, 9AVM, 9AW, 9BBF, 9DOP, 9DTM, 9DZQ, 9HC, 9LW, 9NX, 9XR, 9ZY.

Can. 2BT, Montreal, Canada  
Spark: 1AW, 1DY, 1RV, 1AEV, 1ARY, 1BIR, 2BK, 2DA, 2EL, 2OM, 2RL, 2AIM, 2AJW, 2ARK, 2AST, 2AZY, 3AC, 3BG, 3CG, 3FB, 3HJ, 3IW, 3XM, 3YV, 3ZE, 3ZO, 3ZV, 3ZC, 3AHK, 3ARM, 3AUW, 3BFU, 4EY, 8AY, 8BK, 8CG, 8CI, 8FI, 8HR, 8SP, 8XE, 8AFB, 8AXQ, 8AYS, 8BGT, 9UG, 9MC, 9WU, 9ZJ, 9AIR, 9ASJ, 9AZE, 9DZ, 9DWP, 9BP (Can.)  
CW: 1CF, 1RZ, 1UN, 1XM, 1AGV, 1AJM, 1ARY, 1AZW, 1BCG, 1BDI, 1BEP, 1BFH, 1BQE, 1CAE, 2BB, 2BC, 2EH, 2FD, 2FP, 2GR, 2NN, 2OM, 2RU, 2UD, 2XQ, 2ZV, 2AFP, 2AGB, 2AJF, 2ALR, 2ANZ,

1AWL, 2BAK, 2BEB, 2BML, 3BA, 3BZ, 3FS, 3HG, 3ZO, 3AAE, 4BY, 4GL, 5BA, 5BB, 5HJ, 5XK, 5KM, 5AIL, 5ALY, 5AMM, 5AMQ, 5AQV, 5BFX, 5BOX, 5AKO, WL2, XF1, AN5.

#### 1MD, Dorchester, Mass.

Spark: 1ADC, 1AEV, 1APO, 1ARY, 1AW, 1BCF, 1BVB, 1ABB, 1QO, 1YD, 1ZE, 2AHU, 2AID, 2AIM, 2APB, 2ANQ, 2ASL, 2AWF, 2AUY, 2AZY, 2BJP, 2BK, 2BM, 2CAP, 2CY, 2DA, 2DN, 2DR, 2DX, 2DI, 2EL, 2FP, 2GK, 2JU, 2OM, 2OO, 2PF, 2PV, 2TS, 2WB, 3AC, 3AHF, 3AHK, 3AIC, 3ALN, 3AMW, 3AQR, 3ARM, 3AUW, 3BFM, 3BG, 3BJP, 3CN, 3DM, 3FB, 3FJ, 3FM, 3HG, 3IW, 3OU, 3PU, 3TH, 3TJ, 3VW, 3XM, 3ZA, 3ZO, 3ZV, 4BQ, 4EA, 5ZA, 5ACF, 5AFA, 5AFD, 5AFG, 5AGB, 5AHH, 5AHS, 5AMZ, 5ANO, 5AOT, 5APB, 5ARD, 5AWP, 5AXO, 5AYN, 5BRL, 5BVA, 5BVR, 5CG, 5CH, 5DY, 5DMP, 5FL, 5HY, 5JQ, 5LH, 5OI, 5SP, 5VQ, 5WO, 5XE, 5YAA, 5ZAC, 5ZY, 9AIR, 9AWU, 9AWX, 9AWZ, 9CP, 9DWP, 9HG, 9HR, 9JN, 9KF, 9YB, 9YC, 9ZJ, 9ZN. Hrd in Daylight 1ADC, 1AEV, 1QO, 1ZE, 2AUY, 2AZY, 2CY, 2DA, 2DI, 2DN, 2DR, 2OM, 3HG, 3ZA, 3AMZ, 9CP, Canadians 3BP, 3GE, 3KD, 3LL.

CW: 1ARY, 1BKE, 1BCG, 1BDI, 1BKQ, 1BQI, 1BQT, 1QP, 1QF, 1YK, 1ZL, 2AAB, 2AAX, 2ACQ, 2AGB, 2AGF, 2AJW, 2AWL, 2BEH, 2BRB, 2BRL, 2DE, 2EH, 2FD, 2FP, 2GK, 2HJ, 2JW, 2JX, 2KJ, 2LJ, 2M, 2N, 2O, 2P, 2Q, 2R, 2S, 2T, 2U, 2V, 2W, 2X, 2Y, 2Z, 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I, 3J, 3K, 3L, 3M, 3N, 3O, 3P, 3Q, 3R, 3S, 3T, 3U, 3V, 3W, 3X, 3Y, 3Z, 4A, 4B, 4C, 4D, 4E, 4F, 4G, 4H, 4I, 4J, 4K, 4L, 4M, 4N, 4O, 4P, 4Q, 4R, 4S, 4T, 4U, 4V, 4W, 4X, 4Y, 4Z, 5A, 5B, 5C, 5D, 5E, 5F, 5G, 5H, 5I, 5J, 5K, 5L, 5M, 5N, 5O, 5P, 5Q, 5R, 5S, 5T, 5U, 5V, 5W, 5X, 5Y, 5Z, 6A, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 6I, 6J, 6K, 6L, 6M, 6N, 6O, 6P, 6Q, 6R, 6S, 6T, 6U, 6V, 6W, 6X, 6Y, 6Z, 7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H, 7I, 7J, 7K, 7L, 7M, 7N, 7O, 7P, 7Q, 7R, 7S, 7T, 7U, 7V, 7W, 7X, 7Y, 7Z, 8A, 8B, 8C, 8D, 8E, 8F, 8G, 8H, 8I, 8J, 8K, 8L, 8M, 8N, 8O, 8P, 8Q, 8R, 8S, 8T, 8U, 8V, 8W, 8X, 8Y, 8Z, 9A, 9B, 9C, 9D, 9E, 9F, 9G, 9H, 9I, 9J, 9K, 9L, 9M, 9N, 9O, 9P, 9Q, 9R, 9S, 9T, 9U, 9V, 9W, 9X, 9Y, 9Z, 10A, 10B, 10C, 10D, 10E, 10F, 10G, 10H, 10I, 10J, 10K, 10L, 10M, 10N, 10O, 10P, 10Q, 10R, 10S, 10T, 10U, 10V, 10W, 10X, 10Y, 10Z, 11A, 11B, 11C, 11D, 11E, 11F, 11G, 11H, 11I, 11J, 11K, 11L, 11M, 11N, 11O, 11P, 11Q, 11R, 11S, 11T, 11U, 11V, 11W, 11X, 11Y, 11Z, 12A, 12B, 12C, 12D, 12E, 12F, 12G, 12H, 12I, 12J, 12K, 12L, 12M, 12N, 12O, 12P, 12Q, 12R, 12S, 12T, 12U, 12V, 12W, 12X, 12Y, 12Z, 13A, 13B, 13C, 13D, 13E, 13F, 13G, 13H, 13I, 13J, 13K, 13L, 13M, 13N, 13O, 13P, 13Q, 13R, 13S, 13T, 13U, 13V, 13W, 13X, 13Y, 13Z, 14A, 14B, 14C, 14D, 14E, 14F, 14G, 14H, 14I, 14J, 14K, 14L, 14M, 14N, 14O, 14P, 14Q, 14R, 14S, 14T, 14U, 14V, 14W, 14X, 14Y, 14Z, 15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 15J, 15K, 15L, 15M, 15N, 15O, 15P, 15Q, 15R, 15S, 15T, 15U, 15V, 15W, 15X, 15Y, 15Z, 16A, 16B, 16C, 16D, 16E, 16F, 16G, 16H, 16I, 16J, 16K, 16L, 16M, 16N, 16O, 16P, 16Q, 16R, 16S, 16T, 16U, 16V, 16W, 16X, 16Y, 16Z, 17A, 17B, 17C, 17D, 17E, 17F, 17G, 17H, 17I, 17J, 17K, 17L, 17M, 17N, 17O, 17P, 17Q, 17R, 17S, 17T, 17U, 17V, 17W, 17X, 17Y, 17Z, 18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18K, 18L, 18M, 18N, 18O, 18P, 18Q, 18R, 18S, 18T, 18U, 18V, 18W, 18X, 18Y, 18Z, 19A, 19B, 19C, 19D, 19E, 19F, 19G, 19H, 19I, 19J, 19K, 19L, 19M, 19N, 19O, 19P, 19Q, 19R, 19S, 19T, 19U, 19V, 19W, 19X, 19Y, 19Z, 20A, 20B, 20C, 20D, 20E, 20F, 20G, 20H, 20I, 20J, 20K, 20L, 20M, 20N, 20O, 20P, 20Q, 20R, 20S, 20T, 20U, 20V, 20W, 20X, 20Y, 20Z, 21A, 21B, 21C, 21D, 21E, 21F, 21G, 21H, 21I, 21J, 21K, 21L, 21M, 21N, 21O, 21P, 21Q, 21R, 21S, 21T, 21U, 21V, 21W, 21X, 21Y, 21Z, 22A, 22B, 22C, 22D, 22E, 22F, 22G, 22H, 22I, 22J, 22K, 22L, 22M, 22N, 22O, 22P, 22Q, 22R, 22S, 22T, 22U, 22V, 22W, 22X, 22Y, 22Z, 23A, 23B, 23C, 23D, 23E, 23F, 23G, 23H, 23I, 23J, 23K, 23L, 23M, 23N, 23O, 23P, 23Q, 23R, 23S, 23T, 23U, 23V, 23W, 23X, 23Y, 23Z, 24A, 24B, 24C, 24D, 24E, 24F, 24G, 24H, 24I, 24J, 24K, 24L, 24M, 24N, 24O, 24P, 24Q, 24R, 24S, 24T, 24U, 24V, 24W, 24X, 24Y, 24Z, 25A, 25B, 25C, 25D, 25E, 25F, 25G, 25H, 25I, 25J, 25K, 25L, 25M, 25N, 25O, 25P, 25Q, 25R, 25S, 25T, 25U, 25V, 25W, 25X, 25Y, 25Z, 26A, 26B, 26C, 26D, 26E, 26F, 26G, 26H, 26I, 26J, 26K, 26L, 26M, 26N, 26O, 26P, 26Q, 26R, 26S, 26T, 26U, 26V, 26W, 26X, 26Y, 26Z, 27A, 27B, 27C, 27D, 27E, 27F, 27G, 27H, 27I, 27J, 27K, 27L, 27M, 27N, 27O, 27P, 27Q, 27R, 27S, 27T, 27U, 27V, 27W, 27X, 27Y, 27Z, 28A, 28B, 28C, 28D, 28E, 28F, 28G, 28H, 28I, 28J, 28K, 28L, 28M, 28N, 28O, 28P, 28Q, 28R, 28S, 28T, 28U, 28V, 28W, 28X, 28Y, 28Z, 29A, 29B, 29C, 29D, 29E, 29F, 29G, 29H, 29I, 29J, 29K, 29L, 29M, 29N, 29O, 29P, 29Q, 29R, 29S, 29T, 29U, 29V, 29W, 29X, 29Y, 29Z, 30A, 30B, 30C, 30D, 30E, 30F, 30G, 30H, 30I, 30J, 30K, 30L, 30M, 30N, 30O, 30P, 30Q, 30R, 30S, 30T, 30U, 30V, 30W, 30X, 30Y, 30Z, 31A, 31B, 31C, 31D, 31E, 31F, 31G, 31H, 31I, 31J, 31K, 31L, 31M, 31N, 31O, 31P, 31Q, 31R, 31S, 31T, 31U, 31V, 31W, 31X, 31Y, 31Z, 32A, 32B, 32C, 32D, 32E, 32F, 32G, 32H, 32I, 32J, 32K, 32L, 32M, 32N, 32O, 32P, 32Q, 32R, 32S, 32T, 32U, 32V, 32W, 32X, 32Y, 32Z, 33A, 33B, 33C, 33D, 33E, 33F, 33G, 33H, 33I, 33J, 33K, 33L, 33M, 33N, 33O, 33P, 33Q, 33R, 33S, 33T, 33U, 33V, 33W, 33X, 33Y, 33Z, 34A, 34B, 34C, 34D, 34E, 34F, 34G, 34H, 34I, 34J, 34K, 34L, 34M, 34N, 34O, 34P, 34Q, 34R, 34S, 34T, 34U, 34V, 34W, 34X, 34Y, 34Z, 35A, 35B, 35C, 35D, 35E, 35F, 35G, 35H, 35I, 35J, 35K, 35L, 35M, 35N, 35O, 35P, 35Q, 35R, 35S, 35T, 35U, 35V, 35W, 35X, 35Y, 35Z, 36A, 36B, 36C, 36D, 36E, 36F, 36G, 36H, 36I, 36J, 36K, 36L, 36M, 36N, 36O, 36P, 36Q, 36R, 36S, 36T, 36U, 36V, 36W, 36X, 36Y, 36Z, 37A, 37B, 37C, 37D, 37E, 37F, 37G, 37H, 37I, 37J, 37K, 37L, 37M, 37N, 37O, 37P, 37Q, 37R, 37S, 37T, 37U, 37V, 37W, 37X, 37Y, 37Z, 38A, 38B, 38C, 38D, 38E, 38F, 38G, 38H, 38I, 38J, 38K, 38L, 38M, 38N, 38O, 38P, 38Q, 38R, 38S, 38T, 38U, 38V, 38W, 38X, 38Y, 38Z, 39A, 39B, 39C, 39D, 39E, 39F, 39G, 39H, 39I, 39J, 39K, 39L, 39M, 39N, 39O, 39P, 39Q, 39R, 39S, 39T, 39U, 39V, 39W, 39X, 39Y, 39Z, 40A, 40B, 40C, 40D, 40E, 40F, 40G, 40H, 40I, 40J, 40K, 40L, 40M, 40N, 40O, 40P, 40Q, 40R, 40S, 40T, 40U, 40V, 40W, 40X, 40Y, 40Z, 41A, 41B, 41C, 41D, 41E, 41F, 41G, 41H, 41I, 41J, 41K, 41L, 41M, 41N, 41O, 41P, 41Q, 41R, 41S, 41T, 41U, 41V, 41W, 41X, 41Y, 41Z, 42A, 42B, 42C, 42D, 42E, 42F, 42G, 42H, 42I, 42J, 42K, 42L, 42M, 42N, 42O, 42P, 42Q, 42R, 42S, 42T, 42U, 42V, 42W, 42X, 42Y, 42Z, 43A, 43B, 43C, 43D, 43E, 43F, 43G, 43H, 43I, 43J, 43K, 43L, 43M, 43N, 43O, 43P, 43Q, 43R, 43S, 43T, 43U, 43V, 43W, 43X, 43Y, 43Z, 44A, 44B, 44C, 44D, 44E, 44F, 44G, 44H, 44I, 44J, 44K, 44L, 44M, 44N, 44O, 44P, 44Q, 44R, 44S, 44T, 44U, 44V, 44W, 44X, 44Y, 44Z, 45A, 45B, 45C, 45D, 45E, 45F, 45G, 45H, 45I, 45J, 45K, 45L, 45M, 45N, 45O, 45P, 45Q, 45R, 45S, 45T, 45U, 45V, 45W, 45X, 45Y, 45Z, 46A, 46B, 46C, 46D, 46E, 46F, 46G, 46H, 46I, 46J, 46K, 46L, 46M, 46N, 46O, 46P, 46Q, 46R, 46S, 46T, 46U, 46V, 46W, 46X, 46Y, 46Z, 47A, 47B, 47C, 47D, 47E, 47F, 47G, 47H, 47I, 47J, 47K, 47L, 47M, 47N, 47O, 47P, 47Q, 47R, 47S, 47T, 47U, 47V, 47W, 47X, 47Y, 47Z, 48A, 48B, 48C, 48D, 48E, 48F, 48G, 48H, 48I, 48J, 48K, 48L, 48M, 48N, 48O, 48P, 48Q, 48R, 48S, 48T, 48U, 48V, 48W, 48X, 48Y, 48Z, 49A, 49B, 49C, 49D, 49E, 49F, 49G, 49H, 49I, 49J, 49K, 49L, 49M, 49N, 49O, 49P, 49Q, 49R, 49S, 49T, 49U, 49V, 49W, 49X, 49Y, 49Z, 50A, 50B, 50C, 50D, 50E, 50F, 50G, 50H, 50I, 50J, 50K, 50L, 50M, 50N, 50O, 50P, 50Q, 50R, 50S, 50T, 50U, 50V, 50W, 50X, 50Y, 50Z, 51A, 51B, 51C, 51D, 51E, 51F, 51G, 51H, 51I, 51J, 51K, 51L, 51M, 51N, 51O, 51P, 51Q, 51R, 51S, 51T, 51U, 51V, 51W, 51X, 51Y, 51Z, 52A, 52B, 52C, 52D, 52E, 52F, 52G, 52H, 52I, 52J, 52K, 52L, 52M, 52N, 52O, 52P, 52Q, 52R, 52S, 52T, 52U, 52V, 52W, 52X, 52Y, 52Z, 53A, 53B, 53C, 53D, 53E, 53F, 53G, 53H, 53I, 53J, 53K, 53L, 53M, 53N, 53O, 53P, 53Q, 53R, 53S, 53T, 53U, 53V, 53W, 53X, 53Y, 53Z, 54A, 54B, 54C, 54D, 54E, 54F, 54G, 54H, 54I, 54J, 54K, 54L, 54M, 54N, 54O, 54P, 54Q, 54R, 54S, 54T, 54U, 54V, 54W, 54X, 54Y, 54Z, 55A, 55B, 55C, 55D, 55E, 55F, 55G, 55H, 55I, 55J, 55K, 55L, 55M, 55N, 55O, 55P, 55Q, 55R, 55S, 55T, 55U, 55V, 55W, 55X, 55Y, 55Z, 56A, 56B, 56C, 56D, 56E, 56F, 56G, 56H, 56I, 56J, 56K, 56L, 56M, 56N, 56O, 56P, 56Q, 56R, 56S, 56T, 56U, 56V, 56W, 56X, 56Y, 56Z, 57A, 57B, 57C, 57D, 57E, 57F, 57G, 57H, 57I, 57J, 57K, 57L, 57M, 57N, 57O, 57P, 57Q, 57R, 57S, 57T, 57U, 57V, 57W, 57X, 57Y, 57Z, 58A, 58B, 58C, 58D, 58E, 58F, 58G, 58H, 58I, 58J, 58K, 58L, 58M, 58N, 58O, 58P, 58Q, 58R, 58S, 58T, 58U, 58V, 58W, 58X, 58Y, 58Z, 59A, 59B, 59C, 59D, 59E, 59F, 59G, 59H, 59I, 59J, 59K, 59L, 59M, 59N, 59O, 59P, 59Q, 59R, 59S, 59T, 59U, 59V, 59W, 59X, 59Y, 59Z, 60A, 60B, 60C, 60D, 60E, 60F, 60G, 60H, 60I, 60J, 60K, 60L, 60M, 60N, 60O, 60P, 60Q, 60R, 60S, 60T, 60U, 60V, 60W, 60X, 60Y, 60Z, 61A, 61B, 61C, 61D, 61E, 61F, 61G, 61H, 61I, 61J, 61K, 61L, 61M, 61N, 61O, 61P, 61Q, 61R, 61S, 61T, 61U, 61V, 61W, 61X, 61Y, 61Z, 62A, 62B, 62C, 62D, 62E, 62F, 62G, 62H, 62I, 62J, 62K, 62L, 62M, 62N, 62O, 62P, 62Q, 62R, 62S, 62T, 62U, 62V, 62W, 62X, 62Y, 62Z, 63A, 63B, 63C, 63D, 63E, 63F, 63G, 63H, 63I, 63J, 63K, 63L, 63M, 63N, 63O, 63P, 63Q, 63R, 63S, 63T, 63U, 63V, 63W, 63X, 63Y, 63Z, 64A, 64B, 64C, 64D, 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71W, 71X, 71Y, 71Z, 72A, 72B, 72C, 72D, 72E, 72F, 72G, 72H, 72I, 72J, 72K, 72L, 72M, 72N, 72O, 72P, 72Q, 72R, 72S, 72T, 72U, 72V, 72W, 72X, 72Y, 72Z, 73A, 73B, 73C, 73D, 73E, 73F, 73G, 73H, 73I, 73J, 73K, 73L, 73M, 73N, 73O, 73P, 73Q, 73R, 73S, 73T, 73U, 73V, 73W, 73X, 73Y, 73Z, 74A, 74B, 74C, 74D, 74E, 74F, 74G, 74H, 74I, 74J, 74K, 74L, 74M, 74N, 74O, 74P, 74Q, 74R, 74S, 74T, 74U, 74V, 74W, 74X, 74Y, 74Z, 75A, 75B, 75C, 75D, 75E, 75F, 75G, 75H, 75I, 75J, 75K, 75L, 75M, 75N, 75O, 75P, 75Q, 75R, 75S, 75T, 75U, 75V, 75W, 75X, 75Y, 75Z, 76A, 76B, 76C, 76D, 76E, 76F, 76G, 76H, 76I, 76J, 76K, 76L, 76M, 76N, 76O, 76P, 76Q, 76R, 76S, 76T, 76U, 76V, 76W, 76X, 76Y, 76Z, 77A, 77B, 77C, 77D, 77E, 77F, 77G, 77H, 77I, 77J, 77K, 77L, 77M, 77N, 77O, 77P, 77Q, 77R, 77S, 77T, 77U, 77V, 77W, 77X, 77Y, 77Z, 78A, 78B, 78C, 78D, 78E, 78F, 78G, 78H, 78I, 78J, 78K, 78L, 78M, 78N, 78O, 78P, 78Q, 78R, 78S, 78T, 78U, 78V, 78W, 78X, 78Y, 78Z, 79A, 79B, 79C, 79D, 79E, 79F, 79G, 79H, 79I, 79J, 79K, 79L, 79M, 79N, 79O, 79P, 79Q, 79R, 79S, 79T, 79U, 79V, 79W, 79X, 79Y, 79Z, 80A, 80B, 80C, 80D, 80E, 80F, 80G, 80H, 80I, 80J, 80K, 80L, 80M, 80N, 80O, 80P, 80Q, 80R, 80S, 80T, 80U, 80V, 80W, 80X, 80Y, 80Z, 81A, 81B, 81C, 81D, 81E, 81F, 81G, 81H, 81I, 81J, 81K, 81L, 81M, 81N, 81O, 81P, 81Q, 81R, 81S, 81T, 81U, 81V, 81W, 81X, 81Y, 81Z, 82A, 82B, 82C, 82D, 82E, 82F, 82G, 82H, 82I, 82J, 82K, 82L, 82M, 82N, 82O, 82P, 82Q, 82R, 82S, 82T, 82U, 82V, 82W, 82X, 82Y, 82Z, 83A, 83B, 83C, 83D, 83E, 83F, 83G, 83H, 83I, 83J, 83K, 83L, 83M, 83N, 83O, 83P, 83Q, 83R, 83S, 83T, 83U, 83V, 83W, 83X, 83Y, 83Z, 84A, 84B, 84C, 84D, 84E, 84F, 84G, 84H, 84I, 84J, 84K, 84L, 84M, 84N, 84O, 84P, 84Q, 84R, 84S, 84T, 84U, 84V, 84W, 84X, 84Y, 84Z, 85A, 85B, 85C, 85D, 85E, 85F, 85G, 85H, 85I, 85J, 85K, 85L, 85M, 85N, 85O, 85P, 85Q, 85R, 85S, 85T, 85U, 85V, 85W, 85X, 85Y, 85Z, 86A, 86B, 86C, 86D, 86E, 86F, 86G, 86H, 86I, 86J, 86K, 86L, 86M, 86N, 86O, 86P, 86Q, 86R, 86S, 86T, 86U, 86V, 86W, 86X, 86Y, 86Z, 87A, 87B, 87C, 87D, 87E, 87F, 87G, 87H, 87I, 87J, 87K, 87L, 87M, 87N, 87O, 87P, 87Q, 87R, 87S, 87T, 87U, 87V, 87W, 87X, 87Y, 87Z, 88A, 88B, 88C, 88D, 88E, 88F, 88G, 88H, 88I, 88J, 88K, 88L, 88M, 88N, 88O, 88P, 88Q, 88R, 88S, 88T, 88U, 88V, 88W, 88X, 88Y, 88Z, 89A, 89B, 89C, 89D, 89E, 89F, 89G, 89H, 89I, 89J, 89K, 89L, 89M, 89N, 89O, 89P, 89Q, 89R, 89S, 89T, 89U, 89V, 89W, 89X, 89Y, 89Z, 90A, 90B, 90C, 90D, 90E, 90F, 90G, 90H, 90I, 90J, 90

2RU, 2UA, (2UD), 2UK, 2VA, 2WL, 2XB fone, (2XQ), 2ZA, 2ZL, 3AEB, 3AGL, (3AHK), 3AJB, 3ANJ, 3ANO, 3ATB, (3BA), 3BC, 3BEC, 3BHK, 3BIY, 3CA, 3CC, 3CG, 3DH, 3EM, 3IW, 3MO, 3PB, 3QV, 3XL, 3XM, 3YO, 3ZV, (3ZO), 3FI, 4BY, 4CO, 4GL, 4GX, 4ACF, (4ADG), 4ADR, 4AIL, 4AIO, 4AMK, 4AMM, 4AOG, 4AQI, (4AQV), (4AWP), 4AYZ, 4BEF, 4BFX, 4BJ, (4BK), 4BNI, 4BO, 4BOX, 4BUM, 4BZC, 4DW, 4HF, 4HJ, 4IL, (4IQ), (4JL), 4JQ, 4KY, 4LF, 4UC, 4UK, 4VJ, 4WW, 4ZY, 4DWJ, 4JQ, 4NX, 4PG, 4XAH, 4ZJ.

### 2AGH, Caldwell, N. J.

CW: 1ADB, 1AFV, 1AJF, 1AJM, 1AKA, 1AKB, 1ANQ, 1ARY, 1AWB, 1AZW, 1BCF, 1BCG, 1BDI, 1BEA, 1BEP, 1BIS, 1BKA, 1BKQ, 1BKZ, 1BMY, 1BOQ, 1BQE, 1BQT, 1BSD, 1BUA, 1BWJ, 1CAK, 1CF, 1DH, 1FF, 1PT, 1QN, 1QP, 1QR, 1QW, 1RU, 1RZ, 1TS, 1UN, 1UQ, 1VS, 1XM, 1ZE, 2AAB, 2AAX, 2ABA, 2ACQ, 2ACI, 2ABD, 2ADI, 2AEQ, 2AGB, 2AJA, 2AJW, 2AKO, 2ALR, 2AME, 2AMF, 2AMO, 2ANZ, 2AOS, 2AOG, 2APJ, 2AQU, 2ARZ, 2ASH, 2AUU, 2AVU, 2AWF, 2AWF, 2AWK, 2AWL, 2AYV, 2AYZ, 2AXF, 2BAK, 2BB, 2BDM, 2BEA, 2BEB, 2BEH, 2BGA, 2BGH, 2BGK, 2BH, 2BML, 2BMR, 2BNZ, 2BLO, 2BPD, 2BQT, 2BRE, 2BRB, 2BSC, 2BTW, 2BUM, 2BUA, 2BXG, 2BKX, 2BZY, 2CBT, 2CBW, 2CAF, 2CDK, 2CC, 2CCL, 2CS, 2EX, 2EH, 2FD, 2FF, 2FI, 2HL, 2IA, 2KL, 2KP, 2KU, 2NN, 2OM, 2QR, 2RB, 2RM, 2RU, 2TJ, 2TP, 2UD, 2VA, 2VH, 2VL, 2WB, 2WD, 2WP, 2ZK, 2AAE, 2AAN, 2ADT, 2AEV, 2AHK, 2BAG, 2BEC, 2BIY, 2BG, 2BUW, 2BZ, 2CA, 2DH, 2FS, 2HG, 2IL, 2MO, 2NH, 2QV, 2RF, 2SG, 2TJ, 2XO, 2ZO, 2ZY, 2BQ, 2BY, 2CO, 2EL, 4GL, 4GX, 4XD, 4ZE, 2ABO, 2AC, 2ACF, 2ADG, 2ADR, 2ADY, 2AGZ, 2AHR, 2AIL, 2AIO, 2AIX, 2ALB, 2ALD, 2ALY, 2AMM, 2AMQ, 2ANP, 2AOG, 2APT, 2AQF, 2AQZ, 2AQU, 2AUJ, 2AWF, 2AWF, 2AWX, 2AWY, 2AXU, 2BAD, 2BFE, 2BFX, 2BIX, 2BLT, 2BMW, 2BNJ, 2BNI, 2BO, 2BOX, 2BOZ, 2BK, 2BU, 2BUM, 2BVR, 2BXA, 2BA, 2BAV, 2CDR, 2CG, 2CI, 2DR, 2HJ, 2IB, 2IL, 2IQ, 2IV, 2JQ, 2JS, 2KM, 2KS, 2KH, 2LU, 2LF, 2LX, 2OW, 2QB, 2QY, 2TT, 2UJ, 2UK, 2VJ, 2WR, 2WY, 2XK, 2XM, 2XV, 2ZAE, 2ZV, 2AAS, 2AAV, 2AAY, 2AIH, 2AJA, 2AJH, 2AMB, 2ARK, 2BAP, 2BBG, 2BED, 2BHE, 2DBQ, 2DWJ, 2GL, 2IO, 2LQ, 2WC, 2XAH, 2ZB, 2ZY, Canadian 2BP, 2AW.

Spark: 1ABB, 1AO, 1AEV, 1ARY, 1AW, 1ADC, 1AFO, 1ASF, 1BGF, 1BJW, 1BFZ, 1CHJ, 1COK, 1DY, 1SN, 1YD, 3AIC, 3AQR, 3CG, 3CK, 3CV, 3FG, 3HB, 3HJ, 3LD, 3OU, 3XM, 3ZM, 3ZV, 4AU, 4CX, 4EA, 5DA, 5AAV, 5ACF, 5AFB, 5AFD, 5AFG, 5AGB, 5AHH, 5AIH, 5AJT, 5AKQ, 5AMZ, 5ANO, 5AOT, 5APB, 5ARD, 5AUE, 5AVT, 5AXO, 5AYN, 5AYS, 5BAH, 5BEP, 5BGF, 5BRL, 5BSY, 5BVA, 5BK, 5CAY, 5CF, 5EF, 5HG, 5EW, 5LH, 5KP, 5KY, 5MZ, 5SH, 5SP, 5XE, 5YN, 5YAA, 5ZAC, 5AAP, 5AAW, 5ACB, 5AGR, 5AIR, 5ASJ, 5AJU, 5AYH, 5AZA, 5AZE, 5AMT, 5AWX, 5DHZ, 5DWP, 5HM, 5HR, 5MC, 5ME, 5LF, 5OX, 5TL, 5UU, 5YM, 5ZJ, Canadian 5BP, 5GE, 5JL, 5LI, 5AK.

### 2BEB, Englewood, N. J.

CW: 1AFV, 1AJM, 1ANQ, 1ARG, 1ARY, 1AWB, 1BCG, 1BDI, 1BQE, 1CAC, 1CAK, 1CFJ, 1DF, 1UN, 1ZE, 2BG (Canadian), 2AAE, 2AHK, 2AJB, 2BEC, 2BIY, 2BUW, 2BZ, 2CA, 2CG, 2FG, 2FS, 2HG, 2LR, 2MO, 2MZ, 2NH, 2XY, 2YQ, 2ZO, 2ZY, 4BY, 4EL, 4GL, 4ID, 5UU, 5ADG, 5AGZ, 5AIL, 5AKW, 5ALV, 5AMM, 5AMQ, 5AOG, 5APT, 5AQJ, 5AQV, 5AQZ, 5ARO, 5AWP, 5BFX, 5BK, 5BLT, 5BNI, 5BOX, 5BRC, 5BU, 5BUM, 5BXA, 5BCZ, 5CBK, 5DR, 5IB, 5IV, 5JA, 5JQ, 5OW, 5PS, 5QM, 5SH, 5UK, 5VJ, 5XK, 5XV, 5ZG, 5ZN, 5ZV, 5ZZ, 5AJA, 5ARK, 5LQ, 5NX, 5XAH.

### 2AWF, Albany, N. Y.

Spark: 1AB, 1AEV, 1AO, (1ARY), 1AW, 1AWU, 1AYU, 1BIR, 1BOQ, 1CK, 1HO, 2AJE, 2AST, 2DA, 2EL, 2JU, 2OM, (2OO), 2TS, 3AGT, 3AHK, 3AIS, 3AQK, 3ARM, 3BFS, 3CC, 3DH, 3FB, 3FR, 3HG, 3HJ, 3IW, 3OU, 3TA, 3TH, 3US, 3XM, (3ZA), 3ZV, 3ZV, 4BQ, 4CX, 4EA, 4EY, 4XC, 5DA, 5HK, 5XA, 5XU, 5ACF, 5AFB, 5AHH, 5AHU, 5AJT, 5AKQ, 5AMZ, 5ANV, 5AOT, 5APB, 5AVD, 5AYS, 5BEP, 5BFH, 5BGJ, 5BRL, 5BUK, 5BUN, 5BVA, 5CG, 5DZ, 5EF, 5EW, 5FW, 5HR, 5IV, 5JQ, 5KY, 5OI, 5PQ, 5QC, 5SP, 5TZ, (5XE), 5YAA, 5YN,

5YV, 5ZP, 5ZZ, 9AAP, 9AAW, 9ACL, 9AIR, 9AK, 9AMQ, 9AQM, 9AZA, 9AZE, 9BES, 9DWP, 9DXM, 9HR, 9KF, 9LF, 9QH, 9TL, 9UU, 9VL, 9YB, 9YC, 9ZJ, 9ZN, Can. 9BP, 9FO, 9GE, 9JL.

CW: 1ANQ, 1ARY, (1AVB), (1AZW), 1BCG, 1BDI, (1BEA), (1BOQ), 1BQE, (1BUA), (1ES), 1KM, 1YD, (1ZE), (2AAB), 2AAX, 2AKO, 2BB, 2BFZ, 2BML, (2BRC), 2BSC, 2BUM, 2CDA, (2EH), 2FF, 2OM, 2QR, 2VH, 2WF, 2ZV, 2AAE, 2AAN, 2AFB, 2AHK, 2BC, 2BHL, 2BIY, (2BZ), (2CC), 2KM, (2LR), (2MO), 2XY, 2ZO, 2ZZ, 4BY, 4EL, 4ID, 4YA, 5UU, 5ABO, 5AC, 5ADG, 5AIO, 5AKP, 5ALB, (5AQV), (5AQZ), 5ARW, 5AUO, 5BFX, 5BQT, 5BRC, (5BXA), (5BXH), 5EB, 5IQ, (5JS), 5KX, 5SP, 5WY, 5XV, (5ZAE), 5ZZ, 9AAS, 9AAW, 9AAY, 9AIH, 9AJH, 9AKR, 9EK, 9IL, 9RT, 9XI, 9XM, 9ZJ, 9ZY, DF1, KDKA, NSF, NZO, WDY, WJZ, WL2, Can. 3BP.

### 2OM, Ridgewood, N. J.—Nov.-Dec.

Spark: 1ACK, (1ADC), (1ADL), (1AEV), (1AHF), 1AJT, (1AKG), (1AMD), (1APO), 1ARY, (1ASF), 1ASW, 1ASZ, (1AW), 1AWM, 1AWO, (1AZK), (1BDC), 1BDI, (1BDT), (1BDV), (1BIR), 1BIS, 1BJN, 1BLE, 1BMR, (1BQ), 1BQA, 1BQL, 1BRQ, (1BVB), 1BWZ, (1BYG), 1CAK, 1CEO, 1CHJ, 1CK, (1CM), (1CO), 1COK, (1DY), (1EZ), (1FU), (1GM), 1HK, (1IA), 1MA, (1OE), (1OF), (1RV), (1SN), 1UA, 1XB, 1YB, 1YD, 1ZE, (2PV), (2XQ), (2AWF), (2BP), (2EI), (2FQ), (2GE), (3JL), (3LI), (3QJ), Canadians, (3AC), 3ACE, 3AFB, (3AHF), (3AHK), 3AIG, 3AIS, 3AJD, 3ALL, (3ALN), 3AOZ, (3ARM), (3ARN), 3ATZ, 3AUN, 3AUW, 3BPU, 3BGT, 3BJ, (3CG), 3CK, (3CN), 3PM, 3FB, 3GX, (3HG), (3HJ), (3IW), 3KM, (3LP), (3LY), 3NB, 3NH, (3OU), 3QF, (3RW), 3TH, 3TJ, 3TT, 3UC, 3US, 3VW, 3XF, (3XM), 3YO, (3ZA), (3ZF), 3ZO, 4AL, 4AS, 4BQ, (4BK), (4CX), (4DH), (4DQ), (4EA), (4EY), 4FD, 4GN, (4XC), 5DA, 5EA, 5ER, 5FJ, (5FV), 5HK, 5JD, 5XF, 5XU, 5ZL, 7XD, 7ZU, (8AAE), 8AAG, 8AAV, 8ACF, (8ADE), 8AFB, (8AFD), (8AFG), 8AFS, (8AGB), 8AGF, 8AGK, 8AGT, 8AHE, 8AHF, 8AHH, 8AHS, 8AIB, (8AIG), 8AIZ, (8AJO), (8AJT), 8AJV, (8AJW), 8AKQ, (8ALT), (8AMB), 8AMK, (8AMZ), (8ANO), (8AOI), (8AOT), 8AOU, 8APB, (8AQV), 8AQZ, (8ARD), (8ARG), (8ARS), 8ATU, 8AUE, 8AUR, 8AVI, 8AVO, 8AVT, 8AWR, (8AXN), 8AYN, (8AYS), 8BAH, 8BAI, 8BBY, (8BCO), 8BDE, 8BDL, (8BDY), 8BEN, 8BEP, (8BFH), (8FV), 8HA, 8PB, (8BRL), 8BSY, 8BUA, (8BUN), (8BVA), (8BXK), (8CAY), 8CF, 8CG, 8CI, (8CP), 8CX, 8DE, 8DP, 8DZ, (8EA), (8EB), 8EF, 8EV, (8EW), 8FI, (8FT), 8GW, 8HG, 8HY, 8HU, (8IN), 8JJ, (8JP), 8JQ, (8JU), 8KE, 8KK, (8LH), 8LQ, (8MJ), (8MZ), 8NO, 8OI, 8OJ, 8PM, 8PQ, (8PT), 8QC, 8RB, (8RQ), (8RU), (8SP), (8TJ), 8TK, 8TT, 8TY, 8UC, 8UD, (8UP), 8VI, 8VQ, 8UR, 8VW, 8WA, (8WE), (8WO), 8WZ, (8XE), 8XU, 9YAA, 8YM, 8YN, 8YU, (8ZAC), 8ZG, 8ZO, (8ZN), 8ZR, 8ZY, (9AAW), 9ACB, (9ACY), 9ACZ, 9AEK, 9AEY, 9AF, 9AFF, 9AFK, (9AGH), 9AGR, 9AIP, (9AIR), 9AIU, 9AKR, 9AMA, 9AMK, 9AOE, 9AOJ, 9APK, 9AQE, 9AQM, 9AQV, 9ARG, 9ARZ, 9AS, (9ASJ), 9ASK, 9ASU, (9AU), 9AWX, 9AWZ, 9AXU, 9AZA, (9AZE), 9BDE, (9CP), 9DBW, 9DEH, (9DLX), 9DMJ, 9DOI, 9DPH, 9DQY, (9DWP), 9DXM, 9DYU, 9DZI, 9ET, 9GO, 9GX, 9HM, 9HR, 9IL, 9JN, (9ME), 9MC, (9OX), 9PD, (9PS), (9RC), (9TL), (9UH), (9UU), 9VG, 9VL, 9VZ, (9WT), 9WU, 9YH, 9ZJ, 9ZN, 9ZY.

CW: 1AEV, (1AFV), 1AJF, (1ALY), 1ARY, (1AVI), 1AVR, 1AWB, (1AZW), (1BCG), (1BDI), 1BEA, (1BKQ), 1BMY, 1BSD, (1BWJ), 1CDR, (1ES), (1PE), (1PT), (1QP), 1UN, (1XM), 1ZE, (2XQ), (Can. 3BP), 3AAN, 3ABI, 3AHK, 3BEC, (3BHL), 3CA, (3CG), (3DH), (3EM), 3GR, 3HG, (3HJ), (3IW), (3MO), (3RF), 3ZO, (4BY), 4FF, 4GL, 4GX, 4ID, 5XK CW & voice, (5ADR), (5AGZ), 5AIO, 5ALB, 5AML, (5AMM), 5AQV, 5AWP, (5AXC), 5BCL, 5BEF, (5BFX), 5BK, 5BNJ, 5BNI, 5BO, 5BOX, (5BPL), (5BRL), (5BUM), 5BVR, (5BWK), 5DE, 5DR, (5HJ), (5IB), 5IE, 5IV, 5JL, (5JQ), 5LJ, (5LX), (5PT), 5SE, 5UJ, 5UO, 5UU, 5VJ, 5VO, 5WY, 5XK, 5XM, 5ZAE, 5ZD, 9AAY, 9AMB, (XFI), (X4L), (NZO).

### 2AWS, Freeport, L. I.

Spark: 1ABB, 1ACO, 1ADC, 1AEV, 1AHF, 1AJO,

1AMD, 1AMQ, 1AO, 1APO, 1ARY, 1AW, 1AZK, 1BDT, 1BGH, 1BJN, 1BJY, 1BKO, 1BKQ, 1BOE, 1BRQ, 1BRZ, 1BWY, 1BVB, 1CHJ, 1CK, 1CM, 1DY, 1FV, 1HK, 1HO, 1IA, 1MA, 1OJ, 1QP, 1RV, 1VQ, 1YD, 3AC, 3ACN, 3ACQ, 3ADJ, 3AHK, 3AGR, 3AGT, 3AIC, 3AIS, 3ALN, 3AQZ, 3AQR, 3ARM, 3AS, 3ASK, 3AUW, 3BFU, 3BG, 3BGT, 3BJ, 3CC, 3CG, (3DT), 3DM, (3FB), 3FP, 3GV, 3HJ, 3HW, 3HX, 3IW, 3OV, 3PV, 3QF, 3RW, 3NC, 3UQ, 3US, 3VW, 3XM, 3YV, 3ZY, 4AN, 4BC, 4BX, 4CX, 4EA, 4EY, 4GN, 5DA, 5IW, 5XA, 5XK, 5ACF, 5ADE, 5AFA, 5AFB, 5AFD, 5AFG, 5AFO, 5AHH, 5AHS, 5AHU, 5AIZ, 5AJK, 5AJT, 5AMZ, 5ANV, 5APB, 5AUE, 5AVG, 5AOT, 5AWT, 5AXN, 5AXO, 5AXY, 5AYH, 5AZG, 5BAD, 5BCO, 5BFH, 5BFV, 5BKO, 5BOP, 5BQ, 5BRD, 5BRL, 5BSF, 5BSY, 5BUN, 5BVA, 5BYZ, 5CAY, 5CG, 5DF, 5DZ, 5EF, 5EW, 5EZ, 5FJ, 5HM, 5IA, 5JA, 5JJ, 5JU, 5KY, 5LH, 5ML, 5NO, 5NZ, 5OE, 5UI, 5OW, 5PD, 5RB, 5RG, 5RM, 5SP, 5TK, 5TT, 5UJ, 5VL, 5WD, 5XE, 5YAA, 5YN, 5ZAC, 5ZV, 5ZW, 5AAW, 5AGR, 5AIR, 5ALN, 5AKH, 5ARB, 5AZE, 5ASJ, 5CA, 5CP, 5DKV, 5DWP, 5DXH, 5DXM, 5DYE, 5DYN, 5GX, 5LF, 5ME, 5MC, 5TL, 5UH, 5UN, 5SK, 5VL.

CW: 1AFV, 1AJP, 1AJU, 1ANQ, 1ARY, 1AWB, 1AXI, 1AYL, 1BCA, 1BCG, 1BEA, 1BGF, 1BIL, 1BQE, 1CAK, 1CDR, 1DH, 1FB, 1QP, 1QN, 1RU, 1UN, 1XM, 1ZE, 3AAN, 3ADT, 3AHK, 3AP, 3BA, 3BEC, 3BHA, 3BHL, 3BIY, 3BZ, 3CA, 3CE, 3DH, 3EM, 3FR, 3HS, 3HX, 3KP, 3MO, 3RF, 3XL, 3ZO, 4BY, 4BQ, 4EL, 4GL, 4GX, 4II, 4ZE, 5UU, 5ADG, 5AGZ, 5AHU, 5AIO, 5AKJ, 5ALB, 5AMM, 5AMS, 5AOC, 5AQB, 5AQZ, 5ANO, 5AWP, 5BFX, 5BGY, 5BK, 5BNJ, 5BO, 5BOX, 5BRL, 5BTP, 5BU, 5BUM, 5BWR, 5BXA, 5CI, 5DR, 5EJ, 5HJ, 5IR, 5IV, 5IY, 5JL, 5KM, 5LX, 5TB, 5NO, 5UK, 5VO, 5VW, 5XAE, 5XM, 5AJA, 5AAY, 5AJH, 5AQZ, 5DWJ, 5KR, 5RA, 5VZ, 5ZT, 5ZX, Can. 3GE, 3BP, 3EL, 2BG (CW).

### 3ACY, Hanover, Pa.

Spark: 1AW, 1XD, 1YD, 1ADC, 1AEV, 1APO, 1ARY, 2BK, 2DA, 2DN, 2EL, 2OM, 2PU, 2RB, 2AIM, 2AJE, 2ARB, 2ARK, 2AUK, 2AVE, 2BP, Can. 3GE, 3GM, 3GX, 3KG, 3OV, 3ZO, 3ABP, 3AGT, 3AHK, 3AJD, 3AQR, 3BGH, 4AS, 4BQ, 4CX, 4EA, 4EY, 4FD, 4GG, 4GN, 5DA, 5HK, 5JD, 5XA, 5ZL, 5ZAB, 5JU, 5HP, 5KP, 5KY, 5MJ, 5OI, 5RQ, 5SF, 5VL, 5WO, 5XE, 5ZP, 5ZY, 5AAV, 5AFB, 5AFP, 5AJT, 5AOT, 5APB, 5ARD, 5AUE, 5AYN, 5BCO, 5BEP, 5BFH, 5BSY, 5BVA, 5GN, 5MC, 5UG, 5XO, 5YN, 5AAW, 5ACL, 5AGR, 5AIR, 5ARK, 5ARB, 5ASL, 5DFX, 5DHZ, 5DQY, 5DWP.

CW: 1TS, 1XM ICW, 1ZE, 1ARY, 1AYS, 1BCG, 1BQE, 1BSI, 2BQ, 2CE, 2EH, 2EL, 2FD, 2UD, 2XJ, 2XT, 2XT tone, 2AAX, 2BEA, 2BYS, 2CDA, 3BZ, 3DH ICW, 3HG, 3RF, 3ZO, 3ZY, 3AAE, 3AAY ICW, 3AHK, 3BEC, 3BIY, 4BY, 4CO, 4FF, 4GL, 4XC, 4XD, 4BK, 4EB, 4HJ, 4KH, 4ADY, 4AHH, 4AHR, 4AWP, 4BFX, 4BNW, 4BOX, 4BUM, 4LQ, 4AAS, 4ASJ, WL-2, XF-1.

### 3KM, Washington, D. C.

Spark: Canadian 3BP, 3GE, 1ABB, 1AEV, 1AMD, 1ARY, 1AW, 1BCF, 1BDT, 1BGB, 1BRG, 1BYG, 1CK, 1CM, 1COK, 1HK, 1RV, 1SN, (1YD), 2AHU, 2AIM, 2AJU, 2ARB, 2ARD, 2ARK, 2ARY, 2AST, 2BJO, 2BK, 2DA, 2DI, 2DK, 2EL, 2FP, 2GK, 2OM, 2OO, 2RL, 2TS, 2WB, 3AC, 3AHF, (3AHK), 3AJD, 3ARM, 3BFU, 3FB, 3GX, 3HG, 3HJ, 3OU, 3QW, 3UC, 3XM, 3ZV, 4BQ, 4CX, 4EA, 5DA, 5ER, 5FV, 5SM, 5XA, 5ACF, 5AFB, 5AFD, 5AFG, 5AQY, 5AHU, 5AJT, 5AKQ, 5ALT, 5AMZ, 5AOT, 5APB, 5AQY, 5AUE, (5AXO), 5AYN, 5BCO, 5BFF, 5BFH, 5BUN, 5BVA, 5DY, 5EP, 5FC, 5HG, 5HY, 5ID, 5JJ, (5JK), 5MJ, 5NZ, 5RQ, 5SP, 5TK, 5TT, 5UR, 5VL, 5WE, 5WO, 5XE, 5YAA, 5ZAC, 5AAW, 5AF, 5AIR, 5AIU, 5AQM, 5AZA, 5DQY, 5DWP, 5DXM, 5HR, 5LF, 5MC, 5OX, 5PS, 5TL, 5YC, 5ZJ.

CW: Canadian 3BP, 1AFV, 1AJP, 1ANQ, 1ARY, 1AWB, (1BCF), 1BCG, 1BEA, 1BKA, 1BKQ, 1BMJ, (1PT), 1RU, 1RZ, 1UN, 1XM, 1ZE, 2AAB, 2AAX, 2AJP, 2AJW, 2ANZ, 2AWF, 2AWL, 2AYV, 2BFZ, 2BRB, 2BRC, 2BSC, 2EH, 2EL, 2FD, 2FP, 2KL, 2NN, 2NZ, 2OM, 2RU, 2TS, 2UD, 2VA, 2WL, 2XQ, 2ZL, 3AAE, 3AEF, (3AHK), 3BEC, 3BIY, 3BZ, (3CG), (3DH), 3EM, (3HG), 3MO, 3XAA, 3ZN, 4BY, 4EH, 4GL, 4IL, 4ZF, 5AN, 5ZA, 5ADG, 5ADO, 5AGZ, 5AHR, 5AIL, 5AIO, (5ALB), 5AMM, 5APT,

8AQF, (8AQZ), 8AWF, 8AWP, 8AWY, 8BFG, 8BK, 8BNJ, 8BNU, 8BO, 8BOX, 8BU, 8BUM, 8IL, 8IQ, 8IV, 8JL, 8JS, 8LX, 8ML, 8UJ, 8VJ, 8XV, 8ZV, 9AAV, 9AJA, 9ARK, 9ASJ, 9BBF, 9ZB.

### 3AQW, Trenton, N. J.

Spark: 1AW, 1DY, 1OE, 1RV, 1YD, 1ABB, 1AEV,

(Continued on next page)

## BOB TRUMP

(Concluded from page 47)

that a fuse blows when two hot wires are shorted. In 1913 the radio bug got its hold and in 1914 9JW was started and passed from the spark coil stage to the full 1 K.W. and the status of a star station. He was repeatedly heard on both coasts and by ships at sea off both coasts and worked old 6DM at Phoenix, Arizona, regularly, a distance of 1300 miles. Eastward his constant range was about 600 miles and 3CV in Washington copied 9JW with fair regularity. Perhaps a lot of his range was due to a 120-ft. stick which looked many times that high in flat Kansas.

"BT" was a charter member of the Topeka Radio Club and has held all of the offices of that organization at one time or another. He was also one of the organizers of the old Central Radio Association "from the Rockies to the Ohio" and was on its famous old southwestern route.

When the lid went off in 1919, 9BT was one of the first to open up with the old spark of 9JW. The performance of 9BT was even superior to that of the old station.

A new 9BT is in operation at Ottawa now with a one-half k.w. spark and 20 watts of CW. Ill health has prevented regular watches and late hours but the old Topeka gang tell us that the same touch that made 9JW and 9BT famous is very much in evidence and has made the little bottles perform miracles.

## ROBERT C. HIGGY

(Concluded from page 47)

southwestern route of pre-war days.

When the closing-up orders were issued and war declared, he returned to Columbus, Ohio, and served the latter part of the war as an instructor in signalling at the Ohio State University School of Military Aeronautics.

At the close of war he attended Ohio State University and operated 8IB, the old thunder factory from 6DM with almost pre-war results. Finally when the CW bug got its start, 8IB was converted into CW and has been one of the consistent twitterers from Ohio ever since.

Bob has been in Hartford since mid-December, located right here in the QST Factory, and is going to help us get QST out on time hereafter. He is one of the old A.R.R.L. enthusiastic supporters, and helped to organize the Arizona Radio Association and the Columbus Radio Club, both of which he served as president.



1ARY, 1AZK, 1BIR, 2BK, 2BY, 2CC, 2EL, 2FP, 2NB, 2QR, 2UK, 2WF, 2YA, 2ZC, 2AJE, 2ARY, 2AZY, 3AK, 3BG, 3CC, 3CM, 3CG, 3EH, 3GB, 3HK, 3NR, 3OU, 3OB, 3QW, 3RW, 3TA, 3UD, 3UF, 3UK, 3VP, 3VW, 3XC, 3XM, 3ZA, 3ZO, 3ZQ, 3ZS, 3ZV, 3ABB, 3ACM, 3AHK, 3AHQ, 3ANE, 3ARM, 3AWH, 3ANL, 4AC, 4EA, 4CX, 4GN, 5DA, 5FV, 5XA, 5BA, 5CQ, 5EF, 5EW, 5FI, 5HY, 5JQ, 5PQ, 5QC, 5RQ, 5SP, 5TJ, 5TT, 5TY, 5WO, 5XE, 5YN, 5ZN, 5ZP, 5ZR, 5ZY, 5AFA, 5AFE, 5AFD, 5AFG, 5AHH, 5AHS, 5AJT, 5APB, 5AYN, 5BCK, 5BEP, 5BFH, 5BVA, 5YAA, 5ZAC, 5DF, 5HR, 5JQ, 5AAW, 5AAY, 5ADE, 5AIR, 5DBU, 5DYU, 5DXM, Canadian 3BP.

CW: 1QG, 1QN, 1UN, 1VQ, 1XM, 1ZE, 1AFV, 1AKB, 1ANQ, 1AOL, 1ARY, 1AVA, 1AVR, 1AWB, 1AYL, 1AZW, 1BCG, 1BDI, 1BES, 1BEP, 1BDS, 1BKQ, 1BOQ, 1BWJ, 1CAK, 1CDR, 1CIT, 2BB, 2CB, 2CC, 2CS, 2DN, 2EH, 2EL, 2FP, 2KL, 2KP, 2OM, 2RM, 2RU, 2TJ, 2UD, 2UK, 2VA, 2VH, 2WP, 2XQ, 2XZ, 2ZA, 2ZL, 2ZV, 2AAB, 2AAK, 2AKO, 2AMY, 2ANZ, 2AQU, 2AWF, 2AYV, 2BAK, 2BAY, 2BEB, 2BEH, 2BFZ, 2BGH, 2BIK, 2BIS, 2BLO, 2BND, 2BRG, 2BUA, 2BVH, 2BYS, 2CBG, 2CCP, 2BC, 2BG, 2BP, 2BZ, 2CA, 2CC, 2CG, 2DP, 2DH, 2DR, 2FD, 2FS, 2FR, 2GB, 2HD, 2HG, 2HJ, 2HK, 2IH, 2IW, 2LH, 2KM, 2MO, 2NH, 2OT, 2QV, 2RF, 2RM, 2ST, 2XY, 2ZCN, 2ZO, 2ZY, 2ZZ, 2AAE, 2AAN, 2ADT, 2ADK, 2AEG, 2AEV, 2AHK, 2AJB, 2AKU, 2ALE, 2AMW, 2ANU, 2ANJ, 2APQ, 2AQF, 2BEC, 2BIY, 2BSC, 2BK, 4BQ, 4BY, 4EL, 4GL, 4IL, 4ID, 4LE, 4XC, 5DA, 5ZA, 6WY, 6BK, 6CL, 6DR, 6II, 6IQ, 6IV, 6LU, 6LX, 6ML, 6OW, 6SP, 6UK, 6VM, 6XK, 6XV, 6ZN, 6ZV, 6ZZ, 6ABO, 6ACF, 6AFD, 6AGR, 6AGZ, 6AHR, 6AJU, 6AKJ, 6AKP, 6ALB, 6AQF, 6AQV, 6AQZ, 6AWP, 6BCL, 6BFX, 6BGX, 6BNI, 6BOX, 6BQM, 6BRC, 6BUM, 6BXA, 6ZAE, 6DW, 6II, 6LQ, 6NX, 6ZY, 6AAV, 6AJA, 6AJB, 6AMB, 6ARK, Can. 3BP.

Fone: 1OE, 1XE, 1XAD, 2QR, 2XB, 2XI, 2XJ, 2XR, 2AYZ, 3BB, 3HX, 3PB, 3YQ, 3ZO, 3AWI, 6LI, 8UJ, 8AMQ, 9ZB.

#### 3YV, University, Va.

(1AEV), 1ARY, 1BCG, 1BRW, 1CG, 1RU, 2AHK, 2EH, 2EL, 2FP, 2OM, 2UE, 3AHK, 3AQR, (3BHL), 3DH, 3IW, 3KM, 3PU, 3QW, 3WA, 4AG, 4BQ, 4BY, 4CX, 4EA, 4FD, 4VS, 4YA, 5DA, 5FV, 5ACF, 5AFG, 5AFE, (5AFD), 5AFB, (5AFG), 5AHH, 5AJV, 5AJL, 5AJB, 5AHH, 5AL, 5APB, 5AUE, 5AWP, 5AYN, 5AYS, 5BCO, (5BRL), (5BUN), 5FT, 5HJ, 5HU, 5JQ, 5KE, (5NO), 5QC, 5SP, 5XE, 5ACB, 5AWX, 5AAW, 5MC, 5LF, 5OX, 5UG, 5ZJ, Canadian (5BP).  
CW: 1XM, 2AAX, 2KL, 2MV, (3YO), 4GL, 5BK, 2BB fone.

#### 4GN, Midville, Ga.

Spark: 1AEV, 1AW, 1BDT, 2AIM, 2AJE, 2BK, (2DX), 2EL, 2OM, 2PL, 2QR, 2TS, 3AHK, 3AIA, 3ARM, 3ARY, (3BG), 3BP Can., 3GE Can., 3HG, 3HJ, 3IW, 3XM, 3YV, 3ZV, (4AS), (4AU), (4BC), (4BI), (4BQ), 4BW, 4BX, (4CG), (4CX), (4DH), 4DK, (4DT), (4DZ), (4EA), 4FR, (4GH), 4HJ, 4HS, 4YA, 4YB, 5AA, 5BY, 5DA, 5EK, (5ER), 5QS, 5RO, 5SM, (5XA), 5XU, 5YL, 5ZAB, 5ZT, (5ZL), 5ZX, (5ACF), (5AFB), 5AFD, 5AFE, 5AFG, 5ANB, 5ANO, 5ANY, 5AOI, 5AUE, 5AVO, 5AXU, 5AYN, (5BEN), 5BEP, 5BFH, (5BOG), 5BRL, 5BSY, 5BVA, 5BXK, 5DZ, 5EF, 5EV, (5FT), 5JQ, 5LH, 5LS, 5NO, 5OI, (5RQ), 5HY, (5SP), 5TK, 5UC, 5VQ, 5XE, (5YAA), 5YN, 5ZAC, 5ZY, 5AAW, 5ACB, 5AEG, 5AGH, 5AIR, 5AMK, 5AMS, 5AOJ, 5AOU, (5APS), 5AQE, 5AQM, (5ASJ), 5DGY, 5DNJ, 5DPH, 5DQD, 5DQY, 5DWP, 5DXM, 5DYU, 5FS, 5GP, (5GX), 5HR, 5JN, 5JQ, 5TF, 5ME, 5MC, (5UH), (5UU), (5VL), 5VZ, 5YM, 5ZJ.

CW: 1AFV, 1AJP, 1BCA, 1BCG, 1RU, 1UN, 1XK, 1XM, 1ZE, XF-1, 2AGB, 2ANZ, 2AWL, 2BB, 2BML, 2BRB, 2BYS, 2EH, 2EL, 2FD, 2FP, 2KL, 2NN, 2OE, 2QR, 2WP, 2XQ, WL-2, 3AAE, 3BZ, 3CA, 3DH, 3ZO, NZO, 4BT, 4BK, (4BY), 4CG, 4EB, 4EL, 4GL, 4ID, 4II, 4XC, 5KP, 5LA, 5XB, 5ALV, 5AOA, (5AXC), 5AWP, 5BFX, 5BK, 5BOG, 5BOX, 5BUM, 5DR, 5IB, 5KM, 5LX, 5VJ, 5XK, 5XU, 5ZZ, 5ARK, 5DBU, 5BNO, 5II, 5NX, 5US.

Fone: 3ZO, 9BNO, 8AXC, WDJ, WJZ, KDKA.

#### 4GE, Savannah, Ga.

Spark: 1AW, 1AEY, 2EL, 4BQ, 4AS, 5DA, 5XA, 5ZA, 5ZL, 5ZAB, 5ZY, 5HG, 5BEP, 5AFB, 5YAA, 5AR, 5GN, 5MC, 5YQ, 5ZJ, 5DQX, 5DWP, 5AEK, 5AAW.

CW: 1UN, 1XM, 1BCG, 1BEP, 1AJP, 1XJ, 1QG, 2NN, 2QR, 2EH, 2XQ, 2FP, 2FD, 2AAX, 2AVU, 2AKO, 2AWL, 2AEB, 2AJW, 3MO, 3CA, 3BF, 3BEC, 4EN, 4II, 4FO, 4BQ, 4CO, 4GX, 4ZF, 5LA, 5BU, 5JL, 5IB, 5ZV, 5ZZ, 5XV, 5BOX, 5AQZ, 5BFX, 5AQV, 5II, 5NX, 5RT, 5DWJ, 5XAH, 5FI, 5LI, 5L2, 5AN, 5CN, 3BP.

#### 4II, Orlando, Fla.

CW: 1AFV, 1ARY, 1AZW, 1BDI, (1QN), 2AAX, 2AAB, 2AJW, 2BYS, 2BGZ, 2BIS, (2DN), 2FQ, 2FZ, 2WP, 2BA, 3BZ, 3BIY, 3FM, 3HJ, 3IW, 3KM, 3LR, (3MO), 3SQ, 3VA, (3ZY), (4BK), (4BY), (4CD), 4CY, 4DQ, (4EL), (4GL), 4ID, (4XC), 5FV, 5KP, (5LA), 5MT, 5NZ, 5UU, 5XA, 5YA, (5AQV), 5AQF, 5AWP, 5BZJ, (5BFX), (5BOX), 5CAB, 5DR, 5GV, 5IH, (5IV), 5IQ, 5JS, 5JL, 5KI, (5LX), 5OW, 5UK, (5VJ), 5WY, 5XV, 5ZN, 5ZAE.

#### Univ. of North Carolina, Chapel Hill, N. C.

CW: 1DF, 1RU, 1UN, 1XM, 1ZE, 1AJP, 1ARY, 1AWB, 1BCG, 1BDI, 1BQE, 1BUA, 2BQ, 2NN, 2RB, 2TJ, 2XQ, 2XY, 2WL, 2ZL, 2AAB, 2AAX, 2ADL, 2AFG, 2AVU, 2AWK, 2AWL, 3BZ, 3CA, 3CC, 3FQ, 3FR, 3HX, 3MO, 3RF, 3RV, 3SQ, 3ZO, 3AAN, 3AWI, 4BQ, 4BY, 4CO, 4CY, 4EA, 4EL, 4JH, 4XC, 5EV, 5FB, 5HY, 5IQ, 5JS, 5MQ, 5TB, 5VY, 5WR, 5AHR, 5AKP, 5ALI, 5AQV, 5AWV, 5AWX, 5AWY, 5BEP, 5BFX, 5BKE, 5BMM, 5BMW, 5BNI, 5BJS, 5HK, 5II, 5JD, 5LQ, 5XM, 5YC, 5AAS, 5AJS, 5DDY, 5DKN.

Spark: 1AW, 1DA, 1XE, 1YD, 1AEV, 1AKE, 1ARY, 1BHO, 2BY, 2DA, 2PK, 2TS, 2AAD, 2AGB, 2AHK, 2AHU, 2ASH, 2AST, 3BP, 3DW, 3IW, 3KM, 3QI, 3QW, 3SP, 3TT, 3XF, 3XM, 3XY, 3YM, 3ZJ, 3ZO, 3ZV, 3AAM, 3ACE, 3AHK, 3AOV, 3AQR, 3ARK, 3ARM, 3ATF, 3AUW, 3AVS, 3BFA, 3BJB, 3AXE, 4BX, 4BQ, 4CO, 4CX, 4DA, 4EA, 4XB, 5DA, 5DX, 5EK, 5EG, 5EL, 5FJ, 5JD, 5NR, 5XA, 5ZA, 5ZL, 5ZS, 5ZZ, 5AQ, 5CS, 5EF, 5EO, 5EW, 5JQ, 5NQ, 5RQ, 5SP, 5SQ, 5TK, 5TL, 5TT, 5WO, 5XE, 5XS, 5YL, 5YN, 5ZA, 5ZX, 5ZY, 5AFB, 5AFD, 5AFG, 5AFQ, 5AGY, 5AIS, 5AJT, 5AMZ, 5ALT, 5AOE, 5AOI, 5ARD, 5AUE, 5AWK, 5AWY, 5AYN, 5AXQ, 5BDI, 5BEN, 5BEP, 5BGF, 5BRL, 5BUA, 5BVA, 5BWV, 5ZAA, 5AG, 5AO, 5AM, 5KS, 5DF, 5DQ, 5GN, 5GX, 5HP, 5JN, 5JQ, 5YK, 5PM, 5ME, 5PS, 5SR, 5US, 5YA, 5YB, 5YC, 5YN, 5ZB, 5ZJ, 5AAP, 5ACL, 5AGH, 5AHR, 5AIR, 5AMK, 5AEC, 5ASJ, 5DQD, 5DWP, 5YAC, 5ZAC.  
Fone: 2BB, 2XB, 2XI, 2XR, 2ZZ, 3BZ, 3ZO, 3UV, 9XM.

#### 5CI, Frost, Texas

CW: 1BCG, 4BQ, 4BY, 4CD, 4CO, 4EL, 4LE, 4XC, 4YA, 5AF, (5IR), (5JL), 5LA, (5ME), (5MT), 5XB, 5YI, (5ZA), 5ZAC, 5ZL, 6ALE, 6WV, 6ZZ, 8AUO, 8BEX, 8BOX, 8DV, 8IB, 8IC, 8II, 8IV, 8LX, 8UJ, 8ZG, 8ZV, 8ZZ, 9AAS, 9AAV, 9ACN, 9AIN, 9AJA, 9AJH, 9AKD, 9AMB, 9AVN, 9BAP, 9BAR, (9BBF), 9BEX, 9BHS, (9BIK), 9DVA, 9DWE, 9DWJ, 9DWO, 9DY, 9DZQ, 9FA, (9FM), 9GK, 9II, (9LQ), (9NX), 9RT, 9RY, 9UU, 9VQ, 9XAE, 9XI, 9ZA, 9ZAC, 9ZAF, 9ZB, 9ZJ, 9ZT, 9ZV, XF1, NSF, WL2.

#### 5KN, Port Arthur, Tex.

Spark: 4BQ, 4CO, 4DH, 5AO, 5BM, 5BY, 5CA, 5EW, 5FO, 5HB, 5HK, 5IF, 5IR, 5JD, 5JI, 5KC, 5KD, 5LC, 5MY, 5NC, 5NK, 5NS, 5PE, 5QA, 5QL, 5QQ, 5QS, 5SM, 5XA, 5XB, 5XI, 5XJ, 5XU, 5YI, 5YL, 5ZAB, 5ZS, 5ZW, 5ZZ, 5ZZ, 5AFP, 5YW, 5CF, 5EB, 5AAW, 5AHC, 5AIG, 5AIR, 5ALK, 5AMA, 5AMT, 5ANF, 5AMC, 5AVE, 5DEH, 5DLX, 5DMJ, 5DPA, 5DPH, 5DWJ, 5DZE, 5DZI, 5EL, 5GN, 5HK, 5HM, 5HI, 5HT, 5NX, 5OA, 5OX, 5PS, 5TV, 5WT, 5WU, 5YAK, 5ZAC, 5ZB, 5ZJ.  
CW: 1BCG, 4BY, 4EL, 4FJ, 4GL, 4IL, 4ZF, 5JL, 5XJ, 6WV, 8AWP, 8BFX, 8BO, 8DR, 8II, 8IV, 8VJ, 8VY, 8XK, 9AJH, 9AYU, 9BED.

9BIK, 9BLO, 9BHI, 9DJF, 9DERJ, 9DWJ, 9FM, 9NV, 9TF, 9ZB, 9ZV, 9ZAF.

#### SLO, Miami, Oklahoma

Spark: 4BQ, 4GN, 4XC, 5AE, (5AQ), 5BA, (5BM), 5BY, 5EK, 5EW, (5FO), 5HJ, 5HK, 5HZ, 5IF, 5IR, 5IS, (5JD), 5JI, 5JB, 5KC, 5KP, 5LB, 5MK, 5MY, 5NC, 5NH, 5NS, 5OI, 5PE, 5QI, 5QS, 5RA, 5SM, 5TP, (5XA), 5XB, 5XJ, 5XT, 5YN, (5ZA), (5ZL), 5ZU, 5ZW, 5ZAB, 5ZAG, 5ZAK, 5ZJ, 5KP, 5VL, 5YN, 5ACF, 5AFD, 5ANO, 5AVH, 5BEP, 5ZAC, 5BI, 5BP, 5CA, 5CP, 5DF, 5EE, 5FS, 5GS, 5HI, 5HK, 5HR, 5HM, (5JN), 5JQ, 5JW, 5KF, 5LF, 5LW, 5MC, 5NR, 5OA, 5OI, 5OO, 5OX, 5PI, (5PS), 5QR, 5RC, 5TL, 5UG, 5VA, 5VL, 5WI, 5WT, 5WU, 5YM, 5ZJ, 5ZN, 5AAP, 5ABV, 5ACB, 5ACL, 5ADR, 5AEG, 5AEK, 5AEY, 5AFX, 5AGN, 5AGR, 5AIF, 5AIG, 5AJH, 5AMA, (5AMK), 5ANF, 5ANI, 5ANO, 5OJ, 5OU, 5APN, (5AQE), 5AQM, 5ARG, (5ARZ), 5ASD, 5ATN, (5AVI), 5AWN, 5AWX, 5AYH, 5AYV, 5AYW, 5AZA, 5AZE, 5BDE, 5BDS, (5BNJ), 5BQT, (5BXM), 5DBM, 5DBS, 5DCX, 5DEU, 5DFA, 5DFL, 5DFX, (5DHB), 5DKQ, (5DMJ), 5DPH, (5DQM), 5DSD, 5DVX, 5DWB, 5DWP, (5DXD), 5DXX, 5DYA, 5DYU, 5DZE, 5DZY, (5XAQ), 5YAC, 5YAK, 5NS, MSP.

CW: 1BCG, 2FP, 2PZ, 2ZL, 2AWL, 3AL, 3BL, 3BP, 3BZ, 3MO, 3AHK, 4AE, 4AN, 4AS, 4AT, 4BQ, 4BY, 4CG, 4CN, 4CP, 4DE, 4EH, 4EI, 4EL, 4FD, 4FF, 4GL, 4GN, 4ZC, 5BM, 5BY, 5DA, 5EK, 5ER, 5FA, 5FO, 5FV, 5HK, 5HZ, 5IC, 5ID, 5IF, 5IR, 5IS, 5JD, 5JI, 5KC, 5KP, 5LO, 5LX, 5MA, 5MY, 5ST, 5NC, 5NF, 5NH, 5NK, 5NS, 5OF, 5QA, 5QQ, 5QS, 5QX, 5QY, 5XA, 5XB, 5XJ, 5XK, 5XR, 5XT, 5XU, 5YB, 5YL, 5YN, 5ZA, 5ZC, 5ZI, 5ZL, 5ZO, 5ZR, 5ZS, 5ZT, 5ZU, 5ZW, 5ZX, 5ZAA, 5ZAB, 5ZAF, 5ZAG, 5ZAM, 5ZAK, 5ZAN, 5BK, 5BO, 5BU, 5DE, 5DR, 5FI, 5FG, 5HA, 5HJ, 5II, 5IQ, 5JM, 5JP, 5JQ, 5KX, 5LX, 5OI, 5ON, 5RB, 5SP, 5TN, 5UJ, 5VJ, 5VY, 5XE, 5XK, 5XV, 5YM, 5YN, 5YR, 5ZJ, 5ZK, 5ZL, 5ACF, 5ACL, 5AFB, 5AFD, 5AGK, 5AYN, 5ZG, 5AFS, 5AKS, 5ARD, 5ARG, 5AUH, 5AQF, 5AYN, 5BEN, 5BEP, 5BFL, 5BRL, 5BUM, 5DW, 5EL, 5ET, 5FS, 5FU, 5FZ, 5GN, 5GX, 5HD, 5HI, 5HM, 5HR, 5HS, 5HT, 5IY, 5JN, 5JQ, 5KO, 5LF, 5LW, 5LQ, 5MC, 5ME, 5MN, 5NH, 5NQ, 5NR, 5NX, 5OR, 5OX, 5PS, 5QH, 5RY, 5TV, 5UC, 5UG, 5UH, 5UU, 5VJ, 5VY, 5WI, 5WT, 5WU, 5XI, 5XJ, 5XM, 5YA, 5YB, 5YM, 5YO, 5YT, 5YAE, 5YAK, 5ZB, 5ZJ, 5ZAC, 5AAK, 5AAP, 5AAY, 5ACB, 5ACL, 5ACN, 5AEG, 5AEY, 5AFX, 5AIO, 5AIP, 5AIR, 5AII, 5AJH, 5AMA, 5AMB, 5AMK, 5AMS, 5AMT, 5AMV, 5ANF, 5ANO, 5API, 5AQA, 5AQE, 5AQM, 5AQK, 5ASJ, 5ASL, 5ATI, 5ATN, 5AVN, 5AWN, 5AWX, 5AWU, 5AWZ, 5AXU, 5AYH, 5AYW, 5AZA, 5BBF, 5BCX, 5BDS, 5DAZ, 5DCX, 5DKQ, 5DHP, 5DQL, 5DQK, 5DUG, 5DWJ, 5DWP, 5DXM, 5DYU, 5DZJ.

#### 5JD, Little Rock, Ark.

2FP, (3AHK), 3BP, 3DH, (3XF), 4CG, (4DH), 4YA, 5AA, 5BM, 5DA, (5EK), (5ER), 5FO, 5FV, (5HK), 5IF, (5IR), 5IS, 5JA, 5JI, (5KP), 5LC, 5NC, 5NH, 5NK, (5NS), 5PE, (5QA), 5QI, (5QS), 5QT, 5TG, 5TP, (5UC), (5XA), (5XB), (5XJ), (5XT), (5XU), 5YK, (5YL), 5ZA, (5ZAA), (5ZAB), 5ZAD, 5ZAG, (5ZAK), 5ZAM, 5ZC, (5ZS), (5ZW), 5ZX, (5ACF), 5AEG, 5AFB, 5AIO, (5AUE), (5AYN), (5BEP), 5LX, 5RX, 5XE, (5ZF), 5ZU, (5ZY), 5AAP, 5AAS, 5AAU, (5ABV), 5ACB, 5AEG, 5AFX, 5AIG, 5AIR, 5AJU, (5AMA), 5AMK, 5AMS, 5ANF, 5AOE, 5AOJ, 5AOM, 5AQA, (5AQE),

5AR, 5AUO, 5AWX, 5AYH, 5AYV, 5AYW, 5AZA, 5BKG, 5CP, 5DC, 5DEH, 5DFL, 5ROI, 5DPH, (5DQK), 5DSD, 5DUG, 5DUX, 5DWP, (5DZE), (5DZI), 5DZL, 5EE, (5HI), (5HT), (5JN), (5JQ), 5KO, (5KA), 5LF, 5LQ, 5LW, 5MC, 5NR, (5PS), 5TV, 5UG, 5WI, (5WT), 5XI, 5XM, (5YAE), (5YAK), 5YB, 5YC, (5YM), 5YO, 5ZAA, (5ZAC), (5ZB), (5ZJ), 5ZN, 5ZY.

#### 6ACY, Pasadena, Calif.

5IF, 5ZA, 5ZJ, (6AH), 6AK, 6AS, 6BW, 6CZ, 6DR, (6EX), 6FH, 6FJ, (6FK), (6GF), (6GR), (6GX), (6HC), 6JB, (6KC), 6LU, (6OC), (6OH), (6PJ), 6PR, (6QK), (6QR), 6SK, (6TU), (6TY), 6UO, (6UK), (6VX), (6WZ Spk. & CW), 6WO, 6ZB, 6ZX, 6ZZ, 6AAK, 6AAT CW, 6AAU, 6ABH, (6ABM), (6ACM), 6AEH, (6AEI), 6AEV, 6AFN, (6AGF), 6AGL, 6AKL, 6ALA, 6AMK, (6AOL), 6APH, 6APE, (6ARW), 6ASP, (6ATQ), 6ATV, 6AUD, 6AVB, 6AVC, 6AVW, 6AVZ, 6AWT, (6XAD), 6XAT, 6ZAD, 7BH (7HF), 7HK, 7IN, 7JW, 7KS, (7MF), 7MP, 7HB, 9JI, 9WI, 9WD, 9BD Can., 9AMB, 9ZAF.

#### 6AIF, Bakersfield, Cal.

Spark: 5VQ, (5ZA), 5ZJ, (6AAH), 6AAU, (6ABW), (6ABX), 6AC, (6ACR), 6ACY, 6ADA, 6AEH, 6AEI, (6AEZ), 6AFN, 6AFY, (6AGF), (6AH), (6AHP), (6AHV), 6AHY, (6AIB), 6AIL, (6AIO), 6AJR, 6AK, 6AKL, 6AKT, 6ALA, 6ALL, (6ALP), 6ALU, 6AMK, (6AMN), (6ANG), 6ANI, 6AOA, (6AOE), 6APE, 6ARK, 6ARW, (6AS), 6ATQ, 6ATV, 6AU, 6AUD, (6AVB), (6AVV), 6AWH, 6BAK, 6BAZ, 6BCJ, 6BFE, 6BFX, 6BGL, 6BW, 6CV, 6CZ, 6DA, 6DM, (6EA), 6EB, (6EN), (6EX), (6FH), (6FK), 6GF, 6GP, 6GR, 6GT, 6GX, (6HC), (6IB), 6IK, 6IS, 6JC, 6KA, (6KC), 6KP, 6KS, 6KY, 6LC, 6LU, 6MF, 6MO, (6MH), 6NG, (6OC), (6OD), 6OH, 6OT, 6PC, 6PJ, (6PR), 6PT, (6QR), 6SC, 6SJ, 6ST, (6TF), (6TO), 6TU, 6TV, 6UO, 6VK, (6VX), (6WH), 6WO, 6WZ, 6YN, 6ZAL (ex 6KA), 6ZAM, 6ZB, 6ZE, 6ZU, (6ZX), (6ZZ), (7BA), 7BH, 7BJ, 7BK, 7CW, 7FI, 7FT, (7HF), 7IJ, 7IN, 7IW, (7JD), 7KB, 7KE, 7LY, (7MF), 7MP, 7MU, (7OT), 7TJ, 7YA, 7YG, 7ZB, 7ZO, 7ZP, 7ZT, 7ZU, 9WU, 9YAL, Canadian 9AX, Canadian 9BD.

CW: (5ZA), 6AAT, (6ABX), (6ALE), 6ARC, 6ASJ, 6ASX, (6AUL), 6AVY, 6AWT, 6AWV, 6DR, 6JD, 6JQ, 6JX, 6KM, 6OO, 6WV, 6WZ, (6XAD), 6ZA, 6ZAD, (6ZN), 7XF (CW & ICW), (9AMB), 9BEX, 9DTH, 9DVA, 9NX, 9XM, WL2, CL8, AG1, "MC" (Chihuahua, Mexico).

#### Irving Pinkerton, Nogales, Arizona.

CW: 4GL, 5BBB, 5JL, 5KP, 5XB, 5YI, 5ZA, 5ZAN, 6AVY, 6GD, 6JD, 6LD, 6WV fone, 6XAC fone, 6XAD, 6XAF fone, 6XG, 6XAZ, 6ZA, 6ZB, 6ZN, 6ZZ, 8XK, 8XV, 9AMB, 9ARJ, 9AYJ, 9BJH, 9BJI, 9DES, 9DTM, 9FM, 9NX, 9WD, 9ZAF.

Spark: 5AO, 5BY, 5HK, 5HM, 5IF, 5IR, 5MJ, 5RA, 5XA, 5XJ, 5XU, 5ZA, 5ZAG, 5ZJ, 5ZAK, 5ZR, 5ZZ, 6AAA, 6AAH, 6AAK, 6ACY, 6AEZ, 6AIF, 6ATG, 6EL, 6EN, 6KA, 6KC, 6LC, 6OD, 6QR, 6TV, 6GF, 6ZR, 6ZZ, 7MO, 7YA, 7ZM, 9AQE, 9NR.

#### 6ACM, Berkeley, Calif.

Spark: 6AK, 6BM, 6DA, 6DP, 6EA, 6EB, (6EF), 6EN, 6ER, 6FD, 6FH, 6FK, (6GF), (6GR), 6GT, (6GP), 6GX, (6IS), (6IV), (6KA), 6KC, 6KM, 6KP, 6KS, 6KV, (6KY), (6LC), (6MH), 6OD, 6OH, 6OL, 6OM, (6QR), 6TF, 6TO, 6TV, 6UO, 6VV, 6VZ, 6WH, 6AAB, 6AAK, 6AAS, 6AAU, 6ABM, 6ABP, 6ABW, (6ABX), 6ACY, 6ACZ, 6ADG, 6ADL, 6AEH, 6AEI, 6AFN, 6AFY, 6AFZ, (6AGF), 6AGM, 6AGP, 6AHA, (6AHP), (6AHU), 6AHV, 6AIB, 6AIF, (6AIO), 6AJH, 6AKL, 6AKW, 6ALL, 6ALP, 6ALU, 6AMN, 6ANP, 6ARW, 6AUH, 6AVB, (6AVD), 6AVV, 6AVY, 6BAK, 6BAZ, 6BEZ, 6ZB, 6ZU, 6ZX, 6ZZ, 6ZAL, 7AH, 7BB, (7BH), 7BJ, (7BK), 7BR, 7BS, 7FI, (7HF), 7IN, (7JW), 7KB, 7KE, 7KH, 7KQ, (7MF), 7MU, 7NL, 7NW, 7OT, 7OZ, 7TJ, 7YA, (7ZJ), 7ZK, 7ZN, 7ZT, 7ZU, 9AX, 9CP, 9ED, Can. 9BD.

CW: 6DP, 6PR, 6ABG, 6ABX, 6AJH, 6ALE, 6ALU, (6AOY), 6AOZ, 6XAB, 6XAD, 7XF.

#### 6BM, Grass Valley, Calif.

Spark: 6AAH, 6AAK, (6AAU), 6ABR, 6ABW,

6ABX, 6ADL, 6ACY, 6AEH, 6AEZ, 6AEI, 6AHP, 6AFN, 6AGP, 6AHV, 6AIB, 6AIF, 6AIX, 6AK, (6ALP), 6ALU, 6AMK, 6MNM, 6AMX, 6ANI, 6ANP, 6APE, 6ARW, 6AS, 6ATF, (6AVB), 6AVV, 6AWH, 6BAZ, 6BG, (6BBR), 6BCA, 6BFX, 6DA, 6DP, 6DR, 6EB, 6EN, 6EX, (6FHI), 6FT, (6GR), (6GF), 6GT, 6GX, 6GY, 6IB, 6IS, 6IV, 6JW, 6JY, 6KA, 6KC, 6KY, 6LC, (6LU), 6MH, 6MK, 6MZ, 6NG, 6OD, 6OC, 6OT, 6QK, 6QR, 6RN, 6TO, 6TU, 6TV, 6VM, 6VX, 6ZB, 6ZAM, 6ZAL, 6ZM, 6ZR, 6ZU, 6ZX, (7BH), 7BJ, (7BR), 7FL, 7GE, 7IN, (7IW), 7IY, 7JD, 7KE, 7LN, 7LY, 7MF, 7MU, 7TJ, 7YA, 7YG, 7ZH, 7ZJ, 7ZP, 7ZT, 7ZU, 9AX, 9BD.

CW: 4CB, 5ZA, 6AAG, 6AH, 6ALU, 6AOZ, 6AVY, 6AWV, 6JD, 6JX, 6GY, 6WZ, 6XAD, 6XS, 6ZA, 7BF, 7RN, 7XF, 9JL, CL-8 MC, MR.

Fone: 6AAT, 6AFX, 6ARJ, 6AVR, 6VM, 6XAC, 6XAJ, 6XAG, 6XC, 6XD, 6XG, 7XF, 9ZAF, AGI.

#### 7GK, Evanston, Wyo.

Spark: 5IF, 5LA, 5LO, 5LT, 6AEQ, 6GG, 6IF, 6LA, 6SJ, 6SW, 6ZX, 7EX, 7HW, 7JD, 7LU, 7LY, 7MD, 7ZO, 7ZV, 9AEV, 9AIG, 9AMA, 9AVR, 9EE, 9LW, 9NA, 9NR, 9PE, 9PI, 9SI, 9TG, 9YAK, 9YN.

CW: 6KA, 9AIG, 9AMB, 9BBF, 9DTM.

#### 7FT, Kuna, Idaho

Spark: 5XU, 5ZA, 6AF, 6AK, 6BQ, 6BR, 6CV, 6DP, 6EB, 6FX, 6HX, 6IK, 6IV, 6JJ, 6KM, 6LA, 6LC, 6OA, 6OT, 6SJ, 6TO, 6ZB, 6ZM, 6ZR, 6ZU, 6ZZ, 6ACR, 6AEQ, 6AEZ, 6AIF, 6AIR, 6ALH, 6AME, 6AMK, 6APE, 6AWI, 6AWS, 7BJ, 7DG, 7JD, 7JF, 7LD, 7LK, (7LN), (7LO), 7LY, 7NR, (7OT), 7PY, 7RA, 7RY, 7VO, 7YA, 7YG, 7YJ, 7YL, 7YS, 7ZB, 7ZE, 7ZL, 7ZM, 7ZP, 7ZR, 7ZT, 7ZU, 7ZV, 9EE, 9OA, 9PI, 9LW, 9YA, 9ZX, 9AEY, 9AQE, 9XAK, 9YAK.

CW: 5ZA, 6EN, 6KA, 6WV, 6ZA, 6ALE, 6XG, 6XAC, 6XAK, 7TQ (QRA), 7YA, 7ZE, 9RV, 9XR, 9AAO, 9AMB, 9XAK, 9ZAF.

#### 7GE, Pasco, Wash.

Spark: 6AK, 6AW, 6AX, 6CV, 6DD, 6DP, 6EA, 6EN, 6EX, 6EY, 6GB, 6GF, 6GQ, 6GR, 6GT, 6GY, 6JX, 6KA, 6KM, 6LC, 6LX, 6MH, (6QR), 6TO, 6TU, 6VX, 6VY, 6WZ, 6ZX, 6AAT, 6AAU, 6ABJ, 6ABM, 6ABX, 6AEX, (6AFN), 6AFY, (6AGF), 6AIF, 6ALA, 6ALP, 6AMK, (6APE), 6ARC, 6ARD, 6ASJ, 7AU, (7BA), 7BF, 7BG, 7BH, (7BJ), (7BK), 7BR, 7BZ, 7CW, 7EE, (7FI), 7FL, (7HF), 7HI, 7IM, 7IN, 7IW, 7JF, 7JJ, (7JW), 7KB, 7KE, 7KS, 7LA, (7LY), (7MF), 7MO, 7MY, 7MZ, 7NJ, (7NL), 7NW, 7NZ, 7ON, 7OO, (7TJ), 7TL, 7VO, (7VZ), 7WA, 7WM, 7ZJ, 7ZN, (7ZT), 7ZU, (9AX) Canadian, 9BD, Canadian.

CW: 4CB, 6AA, 7CE, 7XF.

#### 7KS, Astoria, Oregon

6FK, (6GR), 6GX, 6KM, (6LU), 6MG, 6NG, 6OL, 6PG, 6QR, 6TU, 6ZK, 6ZX, 6AAU, 6ABX, 6ADC, (6AGF), 6AIX, 6AMK, 6APE, 6APH, 6ATQ, 6ATZ, 6AWH, 6AWI, 7BH, (7BJ), 7BP, 7DW, 7FI, 7FT, 7HF, 7HM, 7JM, (7KE), (7MF), (7MP), 7NL, 7NN, 7UZ, 7XA, 7YA, 7ZK, 7ZT, Can. 9AX, (Can. 9BD).

#### 8BA, Detroit, Mich.

CW: 1ARY, 1AKB, 1AZW, 1BCG, 1CAK, 1QN, 1RU, 1XM, 1ZE, 2AAX, 2ANZ, 2AUF, (2BAK), 2BFZ, 2BOW, (2BSC), 2BYS, 2CCL, 2EB, 2FD, 2FP, 2FQ, 2KP, 2WP, 2XQ, (2BIY), 3BA, 3BZ, 3EM, 3HG, 3HX, 3LR, 3RF, 3ZY, 4BQ, 4BY, 4EL, 4IL, 8ADR, 8ADY, 8AGZ, 8AQV, 8AUC, 8AWK, 8AWP, 8AXC, 8BDX, (8BET), 8BFX, 8BRL, (8BXA), 8BZO, 8BUM, 8BVR, 8BK, 8CI, 8IV, 8JL, 8LF, 8NX, 8YV, 8VJ, 8XK, 8XL, 8XM, 8XV, 8ZG, (9AJA), 9AWJ, 9BBF, 9DOF, 9XAH, 9AW, 9DV, 9II, 9YB.

Spark: 1AW, 1PT, 2AAM, 2AHK, 2BK, 2CM, 2DN, 2OM, 2RP, 2TS, 3AQR, 3BP, Canadian, (3CG), 3HJ, (3IW), (3VW), 3XM, 3ZO, 3ZV, 4BQ, 4DH, 4EA, 4FD, 4GN, 4YA, 5DA, 5DL, 5HK, 5AFD, 5AHY, 5AIZ, (5AJW), 5APB, 5AUE, (5AVT), 5AVO, (5AWP), 5BDY, 5BEN, 5BGA, (5BGT), (5BRL), 5BVA, 5ZAC, 5ZAN, 5EW, 5JQ, 5KP, 5QC, 5MJ, (5SP), 5UP, 5VL, 5WO, (5XE), 5ZP, (5ACB), 9ALS, 9AMA, 9AMK, (9AOE), 9AQE, 9AQM, 9ASJ, 9AVP, 9AWX, 9AZE,

9BDE, (9DLX), 9DPH, (9DQQ), 9DXM, 9AM, 9CP, 9HM, 9HR, 9JN, 9JQ, 9MC, (9OX), 9QH, 9RY, 9TL, (9UH), 9VA, 9WT, 9ZN.

#### 8BH, Belington, W. Va.

Spark: 1AW, 1BQ, 1BW, 1CC, 1XM, 1YM, 1AEV, 1AME, 1ARB, 1ARY, 1BWP, 2AU, 2BG, 2OM, 2WB, 2AEW, 2AJE, 2AIM, 2AOU, 2AST, 2BAK, 3AN, 3BG, 3CC, 3FB, 3GE, 3HJ, 3LF, 3QR, 3QW, 3SQ, 3XA, 3XT, 3ZV, 3AQR, 3ARM, 4AU, 4BQ, 4CX, 4DQ, 4GS, 4HT, 4XA, 5DA, 5PY, 5XA, 5AC, 5AS, 5AU, 5AX, 5BA, 5BC, 5BN, 5DY, 5DZ, 5EF, 5EO, 5FA, 5FT, 5HG, 5HJ, 5HL, 5HY, 5IN, 5JO, 5JU, 5KY, 5LF, 5LS, 5LX, 5MN, 5NO, 5PJ, 5PP, 5PQ, 5PU, 5RQ, 5SG, 5SP, 5TT, 5TV, 5UR, 5VQ, 5WO, 5WR, 5WZ, 5YN, 5ZL, 5ZN, 5ZY, 5ZZ, 5AAG, 5ACF, 5AER, 5AFB, 5AFD, 5AFG, 5AFZ, 5AHH, 5AIR, 5AIZ, 5AJE, 5AJT, 5AKQ, 5AMZ, 5ANB, 5ANO, 5AOU, 5APB, 5APT, 5AQV, 5ARD, 5ASS, 5ATU, 5ATW, 5AUE, 5VE, 5AYN, 5AYR, 5AYW, 5AYZ, 5YAA, 5BBA, 5BCF, 5BCI, 5BCK, 5BEE, 5BEP, 5BFS, 5BFX, 5BII, 5BPI, 5BPU, 5BRC, 5BSY, 5BUN, 5BVA, 5BWA, 5CAA, 5CAY, 5ZAE, 5AF, 5AS, 5AQ, 5AZ, 5BA, 5CA, 5DR, 5FG, 5FU, 5GX, 5HR, 5MC, 5ME, 5QZ, 5SM, 5SE, 5TF, 5TL, 5TR, 5UH, 5UU, 5UL, 5UV, 5YM, 5ZX, 5AAW, 5AAX, 5ACD, 5AEN, 5AFX, 5AGH, 5AIE, 5APT, 5AHR, 5ASP, 5AUX, 5AYS, 5AYH, 5AYW, 5AZA, 5AZE, 5BDI, 5BFO, 5BTT, 5DBU, 5DMO, 5DQ, 5DRX, 5DSF, 5DVM, 5DWF, 5DXM, 5DYM, 5DYU, 5DYW, 5DYX, 5DZU.

CW: 1AAB, 1AME, 1ARY, 1AWL, 1BWP, 2FP, 2WB, 3CC, 3AHK, 8JQ, 8LJ, 8SP, 8AOO, 8AQV, 8AYZ, 8BBA, 8BFX, 8BIP, 8BPI, 8BRC, 8BUM, 8NX.

#### 8BOX, Tippacanoe City, Ohio

CW: 1BDI, 1BCG, 1ARY, 2(AAB), 2AAX, 2ANZ, 2AKO, (2AWL), 2AAK, 2BML, (2BAK), 2BAD, 2EH, 2FF, 2FD, 2UD, 2VA, 2WX, 2WP, 2XQ, 2ZL, (3AAE), (3AHK), 3BP, (3BIY), 3MO, 3XQ, (3XY), 3YA, 4GL, 4AI, 4BY, 4BQ, 4CO, 4CD, (4EL), 4IL, 4XC, (5JL), 5XB, 5YI, 5ZA, 5AMI, 5APT, 5AJO, 5ARV, (5AKP), 5AIL, 5ADY, (5AXW), 5AQR, (5AUO), 5AQF, (5ADE), 5AQV, 5AGG, 5AOG, 5AMQ, (5AWY), (5ATU Spk.), 5ALY, 5AGZ, 5AHR, (5BK), 5BU, (5BO), 5BXH, 5BCL, (5BFX), (5BEX), (5BMW), 5BDO, 5BZO, 5BBA, 5BZC, (5BUM), 5BRL, 5BOG, (5BSQ Spk.), (5BXA), 5BOW, 5BUL, 5BZJ, (5CAB), 5CBR, 5DV, 5DX, 5FJ, 5GV, 5HD, (5IV), (5IB), 5IC, 5IQ, 5II, 5IJ, 5JQ, 5LJ, (5LF), 5OH, 5LK, 5RG, 5UJ, 5UK, (5UZ fone), 5VJ, 5VY, 5WL, 5XK, 5XV, 5XAE, 5ZU, 5ZG, (5ZZ), 5ZL, (9AJA), (9AAV), (9AUC spk.), (9AMB), (9AGH spk.), 9AVN, 9ARK, 9AKK, 9AKR, 9AKA, (9BBF), (9BIK), 9BED, (9DWJ), 9DP, (9FM), 9FE, 9GK, 9GL, (9II), (9IO), 9JL, (9LQ), 9LF, (9NX), 9KR, (9RT), 9UU, 9UR, 9VG, 9WC, (9XI), 9YAE, 9XM, (9ZN spk.), (9ZY), (9XAH), 9ZB, 9ZC, (NSF), (WL2), (WA9), (XF1).

#### 8LX, Crafton, Penna.

Spark: 1AW, 1RV, 1BDC, 2BK, (2DN), (2EL), (2OM), (2TF), 2XQ, (2ARY), 3BF, Can. 3BP, 3CO, 3DH, 3LP, 3XM, 3ZA, (3AHK), 4ET, 4XC, 5AA, 5DA, 5JD, 5LO, 5XA (dalite), 5XU, 5ZA, 5ZL, 5ZZ, 5AS, 5AY, 5BA, 5CO, 5EA, 5EB, 5EF, 5EZ, 5FT, 5JL, 5NO, (5OI), (5PM), 8QQ, 8SP, 8TJ, 8WZ, 8XE, 8YV, 8ZAA, 8ZAC, 8AFB, 8AFD, 8AGK, (8ANO), (8AQV), 8ARD, 8AYN, 8BAZ, 8BDU, 8BEP, 8BNT, 8XAC, 9AF, 9AM, 9AU, 9AV, 9DQ, 9EE, (9FZ), 9HM, 9HT, 9IF, 9JQ, 9LO, 9LW, (9MC), 9ME, 9MH, (9OX), 9PS, 9TV, (9UH), (9UU), 9XI, 9YA, 9YH, 9YO, 9ZJ, 9ZL, (9ZN), 9ZX, (9AAW), 9AAP, 9ACB, 9AGR, 9AIW, 9AJN, 9AKD, 9ANE, 9AOU, 9AOJ, 9AOX, 9AQM, (9ASN), 9AVE, 9AWW, 9WZ, 9XU, 9AYW, 9DLX, 9DQ, 9DZL, (9YAE), 9YAD, XF1.

CW: 1CF, 1DS, 1PE, 1PT, (1QN), 1QP, 1QR, (1TS), (1VW), 1XM, 1YM, 1ZE, 1AFV, (1AJP), 1ARY, (1AZW), (1BEG), (1BEA), (1BFZ), 1BOI, (1BWJ), (1CAK), (2AW), 2BK, (2DN), 2EH, 2FD, 2FP, (2KL), (2NN), (2OE), (2OM), (2RR), 2TH, (2VA), (2RB), (2WL), (2WP), 2XQ, 2ZV, (2AAB), (2AAX), 2ABR, (2AFP), 2AQU), 2AWO, (2AWL), 2AWV, 2BEB, 2BML, (2BBR), Can. 3BP, 3CA, 3CC, 3DH, (3EM), 3FX, (3IW), 3LR, (3MO), (3RF), 3TJ, (3ZO), (3ZY), (3ZZ), 3AAY, 3AFV, (3AHK), 3BAG, 3BEY, 3BHL, (3BIY),

1BYZ, 4BG, 4BK, (4BQ), (4BY), 4CD, (4CO), (4GL), (4IL), 4XC, 5LA, 5UU, (5XAD), 8AJ, 8BK, (8CP), (8EA), (8EB), (8EW), 8GE, 8GV, (8IB), (8II), (8IV), (8JL), 8KM, 8LU, 8OH, (8OI), (8QY), (8SE), (8SP), 8SZ, (8UJ), (8UK), 8UZ, (8VJ), (8VY), (8WR fone), (8WY), 8ABO, 8AEC, (8AGZ), (8AKJ), 8AKP, (8AMK), (8AMQ), (8ANO), 8AOG, (8AOO), (8APT), (8AQF), (8AQV), (8AQZ), 8ARL, 8AWF, (8AWK), (8AWP), 8AXO, 8BEF, 8BFX, 8BMW, 8BNJ, (8BO), 8BQM, 8BUJ, (8BUM), (8BXA), 8BZC, 8HD, (8HW), (8II), (8LE), 8NX, 8RT, 8VC, (8VD), (8VE), (8VG), 8XI, 8XM, (8ZB), (8ZV), 8ZY, 9AAP, (9AAS), (9AAW), (9AJA), (9AJH), 9ANR, 9ARK, 9ASJ, 9AVB, 9AVN, 9AWW, (9BBF), (WL2), (XF1).

#### SBRI, Roma, N. Y.

Spark: 1ACG, 1AEV, 1APO, 1AW, 1BDT, 1BIS, 1BRW, 1CM, 1CK, 1DY, 1DZ, 1HK, 1HO, 1IA, 1MA, 1ZE, 2AER, 2AGT, 2AHK, 2AHR, 2AHU, 2AID, 2AIM, 2ARB, 2ARM, 2ASF, 2ASL, 2AWZ, 2BK, 2CG, 2DA, 2DN, 2EA, 2EL, 2JW, 2NM, 2OM, 2OQ, 2TS, 3AC, 3AHF, 3AHK, 3AIC, 3AQR, 3BPU, 3BG, 3SG, 3CN, 3DM, 3FB, 3FP, 3IW, 3PU, 3UW, 4AW, 4EA, 5DA, 5ACB, 5ACF, 5APO, 5AHU, 5AJT, 5AKA, 5AKE, 5AMZ, 5AOZ, 5APB, 5ARD, 5AXO, 5BAC, 5BCO, 5BCW, 5BFH, 5BHV, 5BMZ, 5BRL, 5BSY, 5BUH, 5BZU, 5CG, 5CH, 5DC, 5FP, 5HL, 5IX, 5KA, 5KY, 5SP, 5TK, 5TT, 5UC, 5VF, 5YAA, 5AAW, 5AGR, 5AIR, 5DWP, 5GPF, 5HM, 5YM, 5AN, 5EL  
CW: 1AFV, 1AJP, 1BCG, 1BEA, 1BK, 1BKA, 1BQE, 1CDR, 1CJH, 1CYE, 1DA fone, 1FD, 1IN, 1RU, 1UN, 1XM, 1XK, 1YK, 2AGB, 2AJW, 2AWF, 2AWL, 2BEA, 2BML, 2BQ, 2BQT, 2BRB, 2BSC, 2BYS, 2CD, 2EH, 2FC, 2KL, 2OE, 2UD, 2BHL, 2DH, 3HI, 3TR, 4DC, 4GL, 4AHR, 4AMM, 4AWP, 5BUM, 5FO, 5OQ, 5TB, 5UJ, Can. 5UJ, Can. 5AW.

#### SBCK, Cleveland, O.

1AW, 1RV, 1XM, 1ADC, 1AMD, 1APO, 1APW, 1ARY, 1AWK, 1BGF, 1BVB, 2BP, 2BY, 2BQ, 2EL, 2FP, 2OM, 2OO, 2TJ, 2TS, 2WB, 2YH, 2AHS, (2AIM), 2ARB, 2CHJ, 3BG, 3BP, 3CG, 3CN, 3DH, 3HG, 3IW, 3UQ, 3ADJ, 3ADT, 3AHK, 3AQR, 3ARM, 3AUW, 4BQ, 4EA, 4GN, 5XA, 5ZN, 5ZAB, 5NO, (5QH), 5UP, 5VQ, 5YN, 5ACF, (5AIZ), 5AOT, 5ASC, 5AWX, 5YAA, 5CA, 5GX, 5TO, 5UU, 5WD, 5AEG, 5AIU, 5AQM, 5AQR, 5AWX, 5AZA, 5AZR, 5BDS, 5BYU, 5DWP, 5DZE, 5DZU.

#### 9DKQ, Sioux Falls, S. D.

Spark: 2FP, 3UJ, 4CX, 5AL, 5BM, (5BY), 5DA, 5EK, 5ER, 5EW, 5FA, 5FO, 5FV, 5HK, 5IC, (5IF), 5IP, 5IR, 5IS, 5JD, 5LB, 5LU, 5NC, 5ND, 5NK, (5NS), (5PE), 5PU, (5QS), 5RA, 5XU, 5YS, 5ZA, 5ZAF, 5ZAM, 5ZL, 5ZY, 5ZZ, 7LY, 7MO, 7MP, 7ZY, (8AS), 8BI, 8BRL, 8BRM, (8BXC), 8CD, (8CP), 8CW, 8DZ, 8FI, 8HG, 8IR, 8NZ, 8OI, 8SW, 8TC, 8TK, (8WO), 8XD, 8YN, 9AAW, 9ABU, 9ABV, 9AC, 9ACB, (9ACN), 9ACU, 9AEG, 9AF, 9AFC, 9AFX, 9AG, 9AGN, 9AGR, (9AIF), (9AIG), 9AIR, 9AIU, 9AIP, 9LF, (9ALU) (9AMA), 9AMC, 9AMK, (9ANF), (9ANO), 9AOG, (9AOU), 9APC, 9AQE, 9ARK, (9ARZ), 9ASJ, (9ASK), (9ASN), (9ATN), 9AU, 9AUC, 9AUO, 9AQS, 9AWU, 9AWZ, (9AXC), 9AYH, (9AYW), 9AYE, (9AZA), 9AZE, 9AZF, 9BDH, (9BFR, 9BNH, 9CP, 9CX, (9DAG), (9DAT), (9DBU), (9DDP), (9DEH), 9DJG, 9DJB, (9DJX), 9DKV, (9DLF), 9DNC, 9DPS, 9DQJ, (9DSN), (9DSD), 9DUG, 9DWP, 9DYA, (9DYU), (9DZE), 9DZK, 9EE, 9FS, 9GP, 9GX, 9HI, 9HM, 9HT, 9IF, 9JN, 9KN, 9JQ, 9KA, 9KO, 9LF, 9LW, 9LY, 9ME, 9MC, 9NR, 9NQ, (9OA), (9PD), 9PL, 9PS, 9RF, 9RH, 9RP, 9RY, 9TB, 9TI, 9TL, 9UG, 9UU, 9UY, 9VL, 9WU, (9XI), 9YAE, (9YAK), 9YP, 9ZN, 9ZT.  
CW: 5DA, 5LA, 5ZA, 6WP fone, 8BA, 8BE, 8BT, 8BFG, 8BNZ, 8BNJ, 8BP, 8BU, 8CI, 8DR, 8DP, 8FO, 8II, 8KS, 8UO, 8VJ, 9AET, 9AMB, 9ARK, 9BIZ, 9FM, 9LU, 9RU, 9XY, 9ZJ.

#### 9PS, Wichita, Kansas

Spark: (2OM), 3HJ, (4DH), 5AO, (5BY), 5CA, (5EK), (5EW), 5FO, 5HB, (5HK), (5HZ), (5IF), (5IR), (5JD), (5JR), (5MY), 5NC, (5NK), (5PE), (5PU), 5PX, 5QA, (5QI), 5QS, (5SM), 5UG, (5XJ), 5XM, 5XT, (5XU), 5YL, (5ZA), (5ZL), (5ZAB),

(6ZZ), 7ME, (7MP), (7ZO), (7ZU), 8CF, 8CI, (8FT), 8QC, (8RQ), (8SP), 8YN, (8YR), 8YU, (8ZN), 8AAP, 8ALO, (8ARS), 8AYN, 8AYP, 8BBC, 8BOC, 8BXA, (9AU), (9CP), (9CS), (9EL), 9FK, 9GP, (9HI), (9HM), (9HT), (9JN), 9JO, (9JQ), (9KF), (9LW), (9MC), (9NR), (9OA), (9OX), (9PD), (9PL), (9TL), (9UG), 9UU, (9VL), (9WT), (9WU), (9XM), 9XW, 9YM, (9ZB), (9ZJ), (9ZN), 9AAU, (9AAW), 9AGM, (9AIF), (9AIG), 9ALH, (9ALU), (9AMA), (9ANF), (9AOE), (9AOJ), (9AOU), (9APK), 9APN, (9AQM), (9ARG), (9ARI), (9ARZ), 9ATF, 9AVC, (9AVN), (9AWJ), (9AWX), (9AWZ), (9AXU), (9AYV), (9AYW), (9BED), (9BFR), (9BHR), (9DEH), (9DHB), 9DKO, (9DEV), (9DLX), (9DMJ), (9DNC), 9DPB, (9DPH), 9DQM, (9DQJ), (9DVM), (9DZI), 9DZQ, (9YAE), 9YAJ.  
CW: 1BCG, 2ES, (2FP), 2KL, 2XQ, 4LE, 4XA, 4XB, (6WV voice), 6XAD, 7XU, 8AR, 8EB, 8IB, (8JL), 8JZ, (8UJ), (8VJ), 8VK, 8VN, (8VY), 8ZG, 8AGZ, 8APT, 8BOX, (8BUM), (9FM), 9IL, 9JL, 9PE, 9XI, (9XM CW & fone), 9XW, 9YM, (9ZB), 9ZL, 9ZV, 9AAV, (9AJA), 9AJS, (9AMB), (9AOG), 9ARK, (9BBF), 9BED, 9BHS, (9DHB), 9DRK, (9DTW), (9DVA), (9DWJ).

#### 9EA and 9GW, Duluth, Minn.

Spark: 5HK, 5TY, 5ZZ, 8AP, 8AXN, 8EF, 8HY, 8WO, 8ZP, 8ZY, 9AFX, 9AIG, 9AMA, 9AQC, 9ARZ, 9AVE, 9AYA, (9AYW), (9DHJ), 9EE, 9EI, 9HM, 9IP, 9JN, 9LW, 9MC, 9OX, (9WU), 9XI, 9YA, 9YAE, 9YAK, (9ZC).

CW: 1ARY, 1BCG, 2FD, 2WH, 2ZL, 3BZ, 3NB, 3ZY, 4BQ, 5YL, 5ZA, 7FJ, 8ACF, 8AGZ, 8AIL, 8AKP, 8AMB, 8AOG, 8AQF, 8AQU, 8BBF, 8BCF, 8BCX, 8BFX, 8BK, 8BRC, 8BRL, 8BUM, 8DR, 8II, 8IV, 8KM, 8OW, 8UJ, 8VJ, (8VY), 8XK, 8XLB, 8ZG, 8ZV, 8ZY, 8ZZ, 9AAS, 9AJH, (9AJP), 9AWL, 9BAP, (9BBF), 9BI, (9DOF), 9DP, 9DWG, 9DY, 9NX, (9ZY).

#### 9APS, Covington, Ky.

Spark: 1BP, 2BK, 2DA, 2HJ, 2JL, 2OM, 2WB, 2ARY, 3HG, 3ZA, 3AHK, 3AQR, 4AS, 4AU, 4BL, 4BQ, (4CG), 4CX, (4DH), (4DQ), (4GN), (4GU), 4YL, 5AA, 5BN, (5DA), 5ED, 5EK, (5FV), (5HK), 5IS, 5IR, (5JD), 5JM, (5NS), 5QS, 5XA, 5XM, 5XU, 5ZA, (5ZL), 5ZS, (5ZAB), 8CF, 8DF, 8DX, (8EA), (8EF), 8EW, (8IN), 8LS, 8ML, 8NZ, (8OH), (9OI), 8SP, 8XE, 8YW, (8ZF), 8AFD, 8AHH, 8AJK, (8AMZ), (8ANA), 8ANY, (8AOI), 8ASU, (8AUE), 8AVT, 8AXN, 8AYR, 8BDQ, (8BDY), 8BEP, 8BLW, 8BOJ, (8BRL), 8BVE, 8BXC, 8BP, 8CP, 8DF, 8DH, 8EG, (8FU), 8GP, 8HI, (8HR), 8HT, 8IV, (8JN), 8JT, 8KS, 8LF, 8LH, (8MC), 8ME, (8OX), 8PN, 8PS, (8QJ), 8RC, 8SY, 8UU, 8UY, 8VD, 8VL, 8WI, 8WL, (8WT), 8XE, 8XI, 8XM, 8YB, 8YS, 8ZB, 8ZF, 9ZN, 9AAW, 9AAP, 9AEG, 9AEY, 9AEX, 9AGR, 9AKA, 9AMA, 9ANW, 9ANF, 9ANO, (9AOJ), 9AOU, 9PK, 9APN, 9APV, 9AQE, (9AQJ), 9AQM, 9ARZ, (9ARG), (9ASJ), 9ASK, 9ATN, 9AVH, (9AWZ), 9AWU, 9AXU, 9AYS, 9AYW, 9AZA, 9AZE, 9BED, 9DMT, 9DNC, (9DPH), (9DQJ), 9DVM, 9DWP, (9DZE), (9DZI), 9ZAC, 9ZAE, 9ZAK, 9ZC, 9ZD, 9ZE, 9ZF, 9ZG, 9ZH, 9ZJ, 9ZK, 9ZL, 9ZM, 9ZN, 9ZO, 9ZP, 9ZQ, 9ZR, 9ZS, 9ZT, 9ZU, 9ZV, 9ZW, 9ZX, 9ZY, 9ZZ, 9AA, 9AB, 9AC, 9AD, 9AE, 9AF, 9AG, 9AH, 9AI, 9AJ, 9AK, 9AL, 9AM, 9AN, 9AO, 9AP, 9AQ, 9AR, 9AS, 9AT, 9AU, 9AV, 9AW, 9AX, 9AY, 9AZ, 9BA, 9BB, 9BC, 9BD, 9BE, 9BF, 9BG, 9BH, 9BI, 9BJ, 9BK, 9BL, 9BM, 9BN, 9BO, 9BP, 9BQ, 9BR, 9BS, 9BT, 9BU, 9BV, 9BW, 9BX, 9BY, 9BZ, 9CA, 9CB, 9CC, 9CD, 9CE, 9CF, 9CG, 9CH, 9CI, 9CJ, 9CK, 9CL, 9CM, 9CN, 9CO, 9CP, 9CQ, 9CR, 9CS, 9CT, 9CU, 9CV, 9CW, 9CX, 9CY, 9CZ, 9DA, 9DB, 9DC, 9DD, 9DE, 9DF, 9DG, 9DH, 9DI, 9DJ, 9DK, 9DL, 9DM, 9DN, 9DO, 9DP, 9DQ, 9DR, 9DS, 9DT, 9DU, 9DV, 9DW, 9DX, 9DY, 9EZ, 9FA, 9FB, 9FC, 9FD, 9FE, 9FF, 9FG, 9FH, 9FI, 9FJ, 9FK, 9FL, 9FM, 9FN, 9FO, 9FP, 9FQ, 9FR, 9FS, 9FT, 9FU, 9FV, 9FW, 9FX, 9FY, 9FZ, 9GA, 9GB, 9GC, 9GD, 9GE, 9GF, 9GG, 9GH, 9GI, 9GJ, 9GK, 9GL, 9GM, 9GN, 9GO, 9GP, 9GQ, 9GR, 9GS, 9GT, 9GU, 9GV, 9GW, 9GX, 9GY, 9GZ, 9HA, 9HB, 9HC, 9HD, 9HE, 9HF, 9HG, 9HH, 9HI, 9HJ, 9HK, 9HL, 9HM, 9HN, 9HO, 9HP, 9HQ, 9HR, 9HS, 9HT, 9HU, 9HV, 9HW, 9HX, 9HY, 9HZ, 9IA, 9IB, 9IC, 9ID, 9IE, 9IF, 9IG, 9IH, 9II, 9IJ, 9IK, 9IL, 9IM, 9IN, 9IO, 9IP, 9IQ, 9IR, 9IS, 9IT, 9IU, 9IV, 9IW, 9IX, 9IY, 9IZ, 9JA, 9JB, 9JC, 9JD, 9JE, 9JF, 9JG, 9JH, 9JI, 9JJ, 9JK, 9JL, 9JM, 9JN, 9JO, 9JP, 9JQ, 9JR, 9JS, 9JT, 9JU, 9JV, 9JW, 9JX, 9JY, 9JZ, 9KA, 9KB, 9KC, 9KD, 9KE, 9KF, 9KG, 9KH, 9KI, 9KJ, 9KL, 9KM, 9KN, 9KO, 9KP, 9KQ, 9KR, 9KS, 9KT, 9KU, 9KV, 9KW, 9KX, 9KY, 9KZ, 9LA, 9LB, 9LC, 9LD, 9LE, 9LF, 9LG, 9LH, 9LI, 9LJ, 9LK, 9LL, 9LM, 9LN, 9LO, 9LP, 9LQ, 9LR, 9LS, 9LT, 9LU, 9LV, 9LW, 9LX, 9LY, 9LZ, 9MA, 9MB, 9MC, 9MD, 9ME, 9MF, 9MG, 9MH, 9MI, 9MJ, 9MK, 9ML, 9MN, 9MO, 9MP, 9MQ, 9MR, 9MS, 9MT, 9MU, 9MV, 9MW, 9MX, 9MY, 9MZ, 9NA, 9NB, 9NC, 9ND, 9NE, 9NF, 9NG, 9NH, 9NI, 9NJ, 9NK, 9NL, 9NM, 9NO, 9NP, 9NQ, 9NR, 9NS, 9NT, 9NU, 9NV, 9NW, 9NX, 9NY, 9NZ, 9OA, 9OB, 9OC, 9OD, 9OE, 9OF, 9OG, 9OH, 9OI, 9OJ, 9OK, 9OL, 9OM, 9ON, 9OO, 9OP, 9OQ, 9OR, 9OS, 9OT, 9OU, 9OV, 9OW, 9OX, 9OY, 9OZ, 9PA, 9PB, 9PC, 9PD, 9PE, 9PF, 9PG, 9PH, 9PI, 9PJ, 9PK, 9PL, 9PM, 9PN, 9PO, 9PP, 9PQ, 9PR, 9PS, 9PT, 9PU, 9PV, 9PW, 9PX, 9PY, 9PZ, 9QA, 9QB, 9QC, 9QD, 9QE, 9QF, 9QG, 9QH, 9QI, 9QJ, 9QK, 9QL, 9QM, 9QN, 9QO, 9QP, 9QQ, 9QR, 9QS, 9QT, 9QU, 9QV, 9QW, 9QX, 9QY, 9QZ, 9RA, 9RB, 9RC, 9RD, 9RE, 9RF, 9RG, 9RH, 9RI, 9RJ, 9RK, 9RL, 9RM, 9RN, 9RO, 9RP, 9RQ, 9RR, 9RS, 9RT, 9RU, 9RV, 9RW, 9RX, 9RY, 9RZ, 9SA, 9SB, 9SC, 9SD, 9SE, 9SF, 9SG, 9SH, 9SI, 9SJ, 9SK, 9SL, 9SM, 9SN, 9SO, 9SP, 9SQ, 9SR, 9SS, 9ST, 9SU, 9SV, 9SW, 9SX, 9SY, 9SZ, 9TA, 9TB, 9TC, 9TD, 9TE, 9TF, 9TG, 9TH, 9TI, 9TJ, 9TK, 9TL, 9TM, 9TN, 9TO, 9TP, 9TQ, 9TR, 9TS, 9TT, 9TU, 9TV, 9TW, 9TX, 9TY, 9TZ, 9UA, 9UB, 9UC, 9UD, 9UE, 9UF, 9UG, 9UH, 9UI, 9UJ, 9UK, 9UL, 9UM, 9UN, 9UO, 9UP, 9UQ, 9UR, 9US, 9UT, 9UU, 9UV, 9UW, 9UX, 9UY, 9UZ, 9VA, 9VB, 9VC, 9VD, 9VE, 9VF, 9VG, 9VH, 9VI, 9VJ, 9VK, 9VL, 9VM, 9VN, 9VO, 9VP, 9VQ, 9VR, 9VS, 9VT, 9VU, 9VV, 9VW, 9VX, 9VY, 9VZ, 9WA, 9WB, 9WC, 9WD, 9WE, 9WF, 9WG, 9WH, 9WI, 9WJ, 9WK, 9WL, 9WM, 9WN, 9WO, 9WP, 9WQ, 9WR, 9WS, 9WT, 9WU, 9WV, 9WX, 9WY, 9WZ, 9XA, 9XB, 9XC, 9XD, 9XE, 9XF, 9XG, 9XH, 9XI, 9XJ, 9XK, 9XL, 9XM, 9XN, 9XO, 9XP, 9XQ, 9XR, 9XS, 9XT, 9XU, 9XV, 9XW, 9XZ, 9YA, 9YB, 9YC, 9YD, 9YE, 9YF, 9YG, 9YH, 9YI, 9YJ, 9YK, 9YL, 9YM, 9YN, 9YO, 9YP, 9YQ, 9YR, 9YS, 9YT, 9YU, 9YV, 9YW, 9YZ, 9ZA, 9ZB, 9ZC, 9ZD, 9ZE, 9ZF, 9ZG, 9ZH, 9ZI, 9ZJ, 9ZK, 9ZL, 9ZM, 9ZN, 9ZO, 9ZP, 9ZQ, 9ZR, 9ZS, 9ZT, 9ZU, 9ZV, 9ZW, 9ZX, 9ZY, 9ZZ, 9AA, 9AB, 9AC, 9AD, 9AE, 9AF, 9AG, 9AH, 9AI, 9AJ, 9AK, 9AL, 9AM, 9AN, 9AO, 9AP, 9AQ, 9AR, 9AS, 9AT, 9AU, 9AV, 9AW, 9AX, 9AY, 9AZ, 9BA, 9BB, 9BC, 9BD, 9BE, 9BF, 9BG, 9BH, 9BI, 9BJ, 9BK, 9BL, 9BM, 9BN, 9BO, 9BP, 9BQ, 9BR, 9BS, 9BT, 9BU, 9BV, 9BW, 9BX, 9BY, 9BZ, 9CA, 9CB, 9CC, 9CD, 9CE, 9CF, 9CG, 9CH, 9CI, 9CJ, 9CK, 9CL, 9CM, 9CN, 9CO, 9CP, 9CQ, 9CR, 9CS, 9CT, 9CU, 9CV, 9CW, 9CX, 9CY, 9CZ, 9DA, 9DB, 9DC, 9DD, 9DE, 9DF, 9DG, 9DH, 9DI, 9DJ, 9DK, 9DL, 9DM, 9DN, 9DO, 9DP, 9DQ, 9DR, 9DS, 9DT, 9DU, 9DV, 9DW, 9DX, 9DY, 9EZ, 9FA, 9FB, 9FC, 9FD, 9FE, 9FF, 9FG, 9FH, 9FI, 9FJ, 9FK, 9FL, 9FM, 9FN, 9FO, 9FP, 9FQ, 9FR, 9FS, 9FT, 9FU, 9FV, 9FW, 9FX, 9FY, 9FZ, 9GA, 9GB, 9GC, 9GD, 9GE, 9GF, 9GG, 9GH, 9GI, 9GJ, 9GK, 9GL, 9GM, 9GN, 9GO, 9GP, 9GQ, 9GR, 9GS, 9GT, 9GU, 9GV, 9GW, 9GX, 9GY, 9GZ, 9HA, 9HB, 9HC, 9HD, 9HE, 9HF, 9HG, 9HH, 9HI, 9HJ, 9HK, 9HL, 9HM, 9HN, 9HO, 9HP, 9HQ, 9HR, 9HS, 9HT, 9HU, 9HV, 9HW, 9HX, 9HY, 9HZ, 9IA, 9IB, 9IC, 9ID, 9IE, 9IF, 9IG, 9IH, 9II, 9IJ, 9IK, 9IL, 9IM, 9IN, 9IO, 9IP, 9IQ, 9IR, 9IS, 9IT, 9IU, 9IV, 9IW, 9IX, 9IY, 9IZ, 9JA, 9JB, 9JC, 9JD, 9JE, 9JF, 9JG, 9JH, 9JI, 9JJ, 9JK, 9JL, 9JM, 9JN, 9JO, 9JP, 9JQ, 9JR, 9JS, 9JT, 9JU, 9JV, 9JW, 9JX, 9JY, 9JZ, 9KA, 9KB, 9KC, 9KD, 9KE, 9KF, 9KG, 9KH, 9KI, 9KJ, 9KL, 9KM, 9KN, 9KO, 9KP, 9KQ, 9KR, 9KS, 9KT, 9KU, 9KV, 9KW, 9KX, 9KY, 9KZ, 9LA, 9LB, 9LC, 9LD, 9LE, 9LF, 9LG, 9LH, 9LI, 9LJ, 9LK, 9LL, 9LM, 9LN, 9LO, 9LP, 9LQ, 9LR, 9LS, 9LT, 9LU, 9LV, 9LW, 9LX, 9LY, 9LZ, 9MA, 9MB, 9MC, 9MD, 9ME, 9MF, 9MG, 9MH, 9MI, 9MJ, 9MK, 9ML, 9MN, 9MO, 9MP, 9MQ, 9MR, 9MS, 9MT, 9MU, 9MV, 9MW, 9MX, 9MY, 9MZ, 9NA, 9NB, 9NC, 9ND, 9NE, 9NF, 9NG, 9NH, 9NI, 9NJ, 9NK, 9NL, 9NM, 9NO, 9NP, 9NQ, 9NR, 9NS, 9NT, 9NU, 9NV, 9NW, 9NX, 9NY, 9NZ, 9OA, 9OB, 9OC, 9OD, 9OE, 9OF, 9OG, 9OH, 9OI, 9OJ, 9OK, 9OL, 9OM, 9ON, 9OO, 9OP, 9OQ, 9OR, 9OS, 9OT, 9OU, 9OV, 9OW, 9OX, 9OY, 9OZ, 9PA, 9PB, 9PC, 9PD, 9PE, 9PF, 9PG, 9PH, 9PI, 9PJ, 9PK, 9PL, 9PM, 9PN, 9PO, 9PP, 9PQ, 9PR, 9PS, 9PT, 9PU, 9PV, 9PW, 9PX, 9PY, 9PZ, 9QA, 9QB, 9QC, 9QD, 9QE, 9QF, 9QG, 9QH, 9QI, 9QJ, 9QK, 9QL, 9QM, 9QN, 9QO, 9QP, 9QQ, 9QR, 9QS, 9QT, 9QU, 9QV, 9QW, 9QX, 9QY, 9QZ, 9RA, 9RB, 9RC, 9RD, 9RE, 9RF, 9RG, 9RH, 9RI, 9RJ, 9RK, 9RL, 9RM, 9RN, 9RO, 9RP, 9RQ, 9RR, 9RS, 9RT, 9RU, 9RV, 9RW, 9RX, 9RY, 9RZ, 9SA, 9SB, 9SC, 9SD, 9SE, 9SF, 9SG, 9SH, 9SI, 9SJ, 9SK, 9SL, 9SM, 9SN, 9SO, 9SP, 9SQ, 9SR, 9SS, 9ST, 9SU, 9SV, 9SW, 9SX, 9SY, 9SZ, 9TA, 9TB, 9TC, 9TD, 9TE, 9TF, 9TG, 9TH, 9TI, 9TJ, 9TK, 9TL, 9TM, 9TN, 9TO, 9TP, 9TQ, 9TR, 9TS, 9TT, 9TU, 9TV, 9TW, 9TX, 9TY, 9TZ, 9UA, 9UB, 9UC, 9UD, 9UE, 9UF, 9UG, 9UH, 9UI, 9UJ, 9UK, 9UL, 9UM, 9UN, 9UO, 9UP, 9UQ, 9UR, 9US, 9UT, 9UU, 9UV, 9UW, 9UX, 9UY, 9UZ, 9VA, 9VB, 9VC, 9VD, 9VE, 9VF, 9VG, 9VH, 9VI, 9VJ, 9VK, 9VL, 9VM, 9VN, 9VO, 9VP, 9VQ, 9VR, 9VS, 9VT, 9VU, 9VV, 9VW, 9VX, 9VY, 9VZ, 9WA, 9WB, 9WC, 9WD, 9WE, 9WF, 9WG, 9WH, 9WI, 9WJ, 9WK, 9WL, 9WM, 9WN, 9WO, 9WP, 9WQ, 9WR, 9WS, 9WT, 9WU, 9WV, 9WX, 9WY, 9WZ, 9XA, 9XB, 9XC, 9XD, 9XE, 9XF, 9XG, 9XH, 9XI, 9XJ, 9XK, 9XL, 9XM, 9XN, 9XO, 9XP, 9XQ, 9XR, 9XS, 9XT, 9XU, 9XV, 9XW, 9XZ, 9YA, 9YB, 9YC, 9YD, 9YE, 9YF, 9YG, 9YH, 9YI, 9YJ, 9YK, 9YL, 9YM, 9YN, 9YO, 9YP, 9YQ, 9YR, 9YS, 9YT, 9YU, 9YV, 9YW, 9YZ, 9ZA, 9ZB, 9ZC, 9ZD, 9ZE, 9ZF, 9ZG, 9ZH, 9ZI, 9ZJ, 9ZK, 9ZL, 9ZM, 9ZN, 9ZO, 9ZP, 9ZQ, 9ZR, 9ZS, 9ZT, 9ZU, 9ZV, 9ZW, 9ZX, 9ZY, 9ZZ, 9AA, 9AB, 9AC, 9AD, 9AE, 9AF, 9AG, 9AH, 9AI, 9AJ, 9AK, 9AL, 9AM, 9AN, 9AO, 9AP, 9AQ, 9AR, 9AS, 9AT, 9AU, 9AV, 9AW, 9AX, 9AY, 9AZ, 9BA, 9BB, 9BC, 9BD, 9BE, 9BF, 9BG, 9BH, 9BI, 9BJ, 9BK, 9BL, 9BM, 9BN, 9BO, 9BP, 9BQ, 9BR, 9BS, 9BT, 9BU, 9BV, 9BW, 9BX, 9BY, 9BZ, 9CA, 9CB, 9CC, 9CD, 9CE, 9CF, 9CG, 9CH, 9CI, 9CJ, 9CK, 9CL, 9CM, 9CN, 9CO, 9CP, 9CQ, 9CR, 9CS, 9CT, 9CU, 9CV, 9CW, 9CX, 9CY, 9CZ, 9DA, 9DB, 9DC, 9DD, 9DE, 9DF, 9DG, 9DH, 9DI, 9DJ, 9DK, 9DL, 9DM, 9DN, 9DO, 9DP, 9DQ, 9DR, 9DS, 9DT, 9DU, 9DV, 9DW, 9DX, 9DY, 9EZ, 9FA, 9FB, 9FC, 9FD, 9FE, 9FF, 9FG, 9FH, 9FI, 9FJ, 9FK, 9FL, 9FM, 9FN, 9FO, 9FP, 9FQ, 9FR, 9FS, 9FT, 9FU, 9FV, 9FW, 9FX, 9FY, 9FZ, 9GA, 9GB, 9GC, 9GD, 9GE, 9GF, 9GG, 9GH, 9GI, 9GJ, 9GK, 9GL, 9GM, 9GN, 9GO, 9GP, 9GQ, 9GR, 9GS, 9GT, 9GU, 9GV, 9GW, 9GX, 9GY, 9GZ, 9HA, 9HB, 9HC, 9HD, 9HE, 9HF, 9HG, 9HH, 9HI, 9HJ, 9HK, 9HL, 9HM, 9HN, 9HO, 9HP, 9HQ, 9HR, 9HS, 9HT, 9HU, 9HV, 9HW, 9HX, 9HY, 9HZ, 9IA, 9IB, 9IC, 9ID, 9IE, 9IF, 9IG, 9IH, 9II, 9IJ, 9IK, 9IL, 9IM, 9IN, 9IO, 9IP, 9IQ, 9IR, 9IS, 9IT, 9IU, 9IV, 9IW, 9IX, 9IY, 9IZ, 9JA, 9JB, 9JC, 9JD, 9JE, 9JF, 9JG, 9JH, 9JI, 9JJ, 9JK, 9JL, 9JM, 9JN, 9JO, 9JP, 9JQ, 9JR, 9JS, 9JT, 9JU, 9JV, 9JW, 9JX, 9JY, 9JZ, 9KA, 9KB, 9KC, 9KD, 9KE, 9KF, 9KG, 9KH, 9KI, 9KJ, 9KL, 9KM, 9KN, 9KO, 9KP, 9KQ, 9KR, 9KS, 9KT, 9KU, 9KV, 9KW, 9KX, 9KY, 9KZ, 9LA, 9LB, 9LC, 9LD, 9LE, 9LF, 9LG, 9LH, 9LI, 9LJ, 9LK, 9LL, 9LM, 9LN, 9LO, 9LP, 9LQ, 9LR, 9LS, 9LT, 9LU, 9LV, 9LW, 9LX, 9LY, 9LZ, 9MA, 9MB, 9MC, 9MD, 9ME, 9MF, 9MG, 9MH, 9MI, 9MJ, 9MK, 9ML, 9MN, 9MO, 9MP, 9MQ, 9MR, 9MS, 9MT, 9MU, 9MV, 9MW, 9MX, 9MY, 9MZ, 9NA, 9NB, 9NC, 9ND, 9NE, 9NF, 9NG, 9NH, 9NI, 9NJ, 9NK, 9NL, 9NM, 9NO, 9NP, 9NQ, 9NR, 9NS, 9NT, 9NU, 9NV, 9NW, 9NX, 9NY, 9NZ, 9OA, 9OB, 9OC, 9OD, 9OE, 9OF, 9OG, 9OH, 9OI, 9OJ, 9OK, 9OL, 9OM, 9ON, 9OO, 9OP, 9OQ, 9OR, 9OS, 9OT, 9OU, 9OV, 9OW, 9OX, 9OY, 9OZ, 9PA, 9PB, 9PC, 9PD, 9PE, 9PF, 9PG, 9PH, 9PI, 9PJ, 9PK, 9PL, 9PM, 9PN, 9PO, 9PP, 9PQ, 9PR, 9PS, 9PT, 9PU, 9PV, 9PW, 9PX, 9PY, 9PZ, 9QA, 9QB, 9QC, 9QD, 9QE, 9QF, 9QG, 9QH, 9QI, 9QJ, 9QK, 9QL, 9QM, 9QN, 9QO, 9QP, 9QQ, 9QR, 9QS, 9QT, 9QU, 9QV, 9QW, 9QX, 9QY, 9QZ, 9RA, 9RB, 9RC, 9RD, 9RE, 9RF, 9RG, 9RH, 9RI, 9RJ, 9RK, 9RL, 9RM, 9RN, 9RO, 9RP, 9RQ, 9RR, 9RS, 9RT, 9RU, 9RV, 9RW, 9RX, 9RY, 9RZ, 9SA, 9SB, 9SC, 9SD, 9SE, 9SF, 9SG, 9SH, 9SI,



### Third-Fourth Convention

Say, fellows, there is going to be a REAL convention in Washington on the 17th and 18th of February—the third annual convention of the Third and Fourth Radio Districts, with every radio man and woman from all ten districts invited to be the guests of the Third and Fourth.

Pep abounds in those districts and they have many extremely live clubs with many members. That means all the strong committees needed to do a good job, and they have been going at it in a wonderful fashion. Even got out a printed "progress report" for the benefit of the numerous interlocking committees. That means efficiency, no loose ends, and things well thought out. Besides, it's an A.R.R.L. gang.

Everything will be at one place—the Hotel Raleigh, Washington, D. C., Friday and Saturday, Feb. 17 and 18, are the dates. Everything is covered by one ticket—price \$5.00—which bears coupons for the different events. Here's the boiled-down program:

#### Friday the 17th

10:30 to 12:00 a.m.—Welcome and get-together meeting, with some novel stunts promised too.

1:30 to 5:00 p.m.—Main business and technical meeting, interspersed with stunts by clubs of the 3d and 4th.

7:30 p.m.—Contests, with valuable prizes. Radio Exhibits all of both days—yes—a radio show.

#### Saturday the 18th

9:00 a.m. to 12:30 p.m.—A tour to NSF, the Naval Air Station at Anacostia, and to Arlington, NAA, to see time sigs sent out on the big spark, the trip going via Washington's famous landmarks and public buildings.

2:00 to 4:00 p.m.—Technical meeting on rectifiers.

Tickets cover everything. They may be obtained from the Convention Manager, H. A. Snow, 1656 Newton St. N. W., Washington; the Publicity Manager, E. R. Bateman, 1217 W. Lafayette St., Baltimore; or the Radio Publicity Manager, H. A. Beale, Jr., Parkesburg, Pa. For any further information write to Publicity Manager Bateman.

Tiresome talks are verboten. Every talk will be at a scheduled time with an alarm clock to limit it, none permitted over 30 minutes, every one will be illustrated with apparatus or slides, there will be a scheduled time for discussion of each talk, and the meeting will be jazzed up with interspersed stunts, of which there are a startling number and variety. This Convention has boldly tackled one of Amateur Radio's biggest practical problems and is going to have a technical meeting wholly devoted to Rectifiers for C.W., with talks on four distinct types, every one with demonstrations: Electrolytic type of garden variety, by S. Kruse; a new electrolytic not using aluminum, by G. L. Bidwell; Kenotrons, by somebody from Schenectady; and the new Amrad "S" tube, by Mr. H. J. Tytzer of that company. Other technical talks will include one by Dr. J. M. Miller, of the U.S.N. Radio Research Laboratory, on antenna design and improvement. Dr. Miller built an antenna at the Bureau of Standards that had a resistance of but 2 ohms at 300 meters! He is the only man on the whole program who hasn't a time limit put on his talk—he can go as far as he likes and we all eat it. Then there will be talks on various methods of phone modulation, a demonstration of a new receiving set where tickling does not affect tuning at all, counterpoises, tube transmission, etc.

Washington is our Capitol City, one of the most beautiful in the country, and that's another reason for going. There will be a welcome committee of 130, including a goodly number of the gentler persuasion, and ladies are specifically invited. When you hit the Union Station, watch for members of this committee, who will meet every train during the two days starting at 7:30 a.m. on Friday. Watch for a big white badge with an A.R.R.L. emblem on it—that's a welcomer. They're there to meet you and every one will be able to give you instant information about hotels, rates, reservations, transportation, the program, places of interest, location of stations, etc.

The tour to NSF and NAA will take in many of Washington's most interesting sights. At NSF "LC" will be on deck to explain, and at Arlington there will be a talk by Scanlin, of the original crew of NAA. The ride to and from these places

is part of the regular ticket—no extra charge.

Listen for frequent broadcasts of convention dope by some two hundred prominent stations in every district—spark, fone, C.W., and I.C.W. The latest news will be sent out every night.

As we remarked editorially, this is a crowded issue of QST. There isn't any more room, but there is lots more we could tell—speed contests with prizes for best receiving and sending (see 3XF or 3KM), a flock of stunts by the clubs themselves that will liven up every meeting—but you've got to go to Washington anyhow, don't you? That impulse you feel stirring in you is the correct thing, OM—take a tip and make your arrangements RIGHT AWAY QUICK—CU there!

Anderson Radio Assn.  
Austin Radio Club.  
Birmingham Wireless Assn.  
Blackstone Valley Radio Assn.  
Bridgeport Radio Club.  
Brockton District Radio Club.  
Butte Radio Club.  
Canton Radio Club.  
Cass Radio Club.  
Chester County Radio Assn.  
Chicopee Radio Assn.  
Cleveland Radio Assn.  
Community Radio Club.  
Coneat Radio Club.  
Crescent Radio Club.  
Detroit Radio Assn.  
Duluth Radio Assn.  
Electric City Radio Club.  
Elizabeth Radio Club.  
Elmhurst Radio Club.  
Eureka Radio Club.  
Ft. Worth Radio Klub.  
Mobile Radio Club.  
Montreal Radio Assn.  
New Haven Radio Assn.

Do you find the name of your club or association among those listed above? If so it means that we want some information from you as to what you are doing in radio. Come out of your shell and let us hear from you. If you are active let us all know about it. If there is no life—well, we won't hear from you.

Tell us what you do to increase interest and membership in your club. What method do you use to bring your members to all meetings? What kind of meetings do you hold and when do you hold them? How many of your members have complete stations in operation? How much relay traffic do you handle? How many stations are spark and how many CW of those who have stations? What long distance records have your members made? Why don't you send in a list of calls heard?

Those are some of the things we would like to know and no doubt they would

prove of value to other clubs. This whole department is for our Affiliated Clubs and it is up to you to send in your reports. Don't wait for us to ask you for them; send them in and let the outside world know what you are doing.

#### Club News

At the annual banquet of the Delaware Radio Association which was held in Wilmington the following officers were elected for the year 1922: W. B. Osmond, pres.; H. Dunbar, vice-pres.; E. M. Symmes, secy.; F. R. Gooding, treas. E. W. Dannals and L. Manuel of the U. S. S. Ohio were the speakers of the evening and they spoke on arc and spark transmission. J. E. Delps, president of the Philadelphia Amateur Wireless Association, made an address on organization. In addition to the entire membership of the Delaware Radio Association, many prominent business men attended the meeting.

The Springfield, (Mass.) Radio Association is installing a 100-watt CW set for the use of its members. Demonstrations of radio fone in various organizations in and around Springfield are being given, which have resulted in a large increase in membership, the association taking in 32 new members during November.

New officers of the Philadelphia Amateur Radio Association were elected at a regular meeting December 5, 1921: Dr. G. M. Christine, pres.; J. Delp, jr., vice-pres.; B. Martin, secy. and treas.; J. Forsyth, cor. secy. Mr. E. C. Powell read a paper on "Data on Radio Frequency Coils for Reception." Mr. Stanley Bryce read a paper on "Long and Short Wave Receivers." After the papers were read a short time was devoted to discussion. At a meeting held on December 19th Professor Noll read a paper on "Relief from QRM" and J. E. Delp read a paper on "An Improvement Regarding the English Amplifying Circuit."

Regular meetings of the Twin City Radio Club (Lewiston, Me.) are held every Thursday evening at the Jordan High School. The club consists of full members and student members, a total of 28, which number is increasing steadily. 1BRQ is the headquarters station, at which a nightly watch is kept from 10 to 12.

Eighty-five amateurs attended the First Annual Banquet of the Youngstown (Ohio) Radio Club. After enjoying a "fine feed" the meeting was addressed by R. L. Patch, Rev. Father Manning (8ZG, we all know him very well), and Prof. H. W. Harmon of Grove City College. Messrs. Ropar and Daker put on a little skit entitled "A Message from Mars," which was the hit of the evening. Wayne Shaffer, toastmaster, was presented with a rubber con-



tact key in appreciation of his efforts with a side-swiper at 8GW.

Delegates from a radius of 200 miles attended the First South Dakota Radio Convention on December 28-29. It was a real howling ARRL convention and a huge success. (All ARRL Conventions have been successes; the ARRL makes them such.) Dean L. E. Akeley of the U. of S. D. addressed the meeting on a scientific subject. Boyd Phelps, Manager of the Dakota Division, was a big attraction, assisted by A. C. Anderson, president of the Twin City Radio Club, (Minneapolis and St. Paul.) Orville Wheelon was christened the Young Squirt of the convention. A committee was appointed to formulate plans for a state organization. "A Night at 9YAK," a playlet, was the hit at the banquet. Some disappointment was due to the fact that exhibitors failed to exhibit.

The new officers in the Radio Club of Tacoma, (Wash.) for the coming six months, as elected Nov. 22nd are: Howard Reichert, 7CE, president; Karl Weingarten, 7BG, vice-president; Winifred Dow, 7CB, secretary, (re-elected); Neville Benoit, 7BC, treasurer, and Alvin Stenoso, 7LV, press agent and assistant secretary.

On Dec. 7th, the Radio Club of Tacoma took twenty of the members and their friends to surprise the newly organized club of Olympia. Cider, coffee, and cake were part of the main features, and the words, "fill 'er up again boys" still haven't left our memory, (not referring to the coffee). However, as the cider was perfectly fresh, there were no disastrous results. 7BA and the club's saxophone quartet was another main feature, and they furnished some mighty fine "jazz." Before we knew it, everybody was on the "hop." Time slipped by unheeded and it was well toward the "wee hours" of morning before the Tacoma bunch bid farewell and started on the 35 mile drive home. But everybody was happy, and we won't soon forget the enjoyable time. If Olympia members turn out as well every meeting as they did that night, all I've got to say is that we bigger clubs will have to step to keep ahead.

Reported by 7CB.

"Static" is the official publication of the Ridgewood Radio Club of Ridgewood, N. J. It is not the kind of QRN that you get during the summer months, but a real interesting mimeographed outline of what is going on in New Jersey. In addition to some darn good operators in the club they have some fair poets; get this one:

*"Behold here the web of the spider,  
It works without switchpoint or slider,  
It makes 'em all roar  
When you open the door,  
And they fade when you open it wider."*

## CALLS HEARD

(Concluded from page 59)

9AJA, 9APH, 9AMB, 9AQR, 9ARJ, 9ARM, 9ARR, 9AYS, 9AYU, 9BBF, 9BEP, 9BJI, 9DEH, 9DQM, 9DTM, 9DVA, 9DMJ, 9DWO.

9AHC, 9BAD and 9DUZ, Ellendale, N. D.

CW Canadian, 3BP, 4CB, 9AW, U.S.: 1AFV, 1BCG, 1RU, 1XM, 2AKO, 2AWF, 2AWL, 2BFZ, 2BML, 2FD, 2FP, 2KF, 2OE, 2QR, 2WP, 2XQ, 2ZL, 2ZV, 3LR, 3NB, 4EH, 4EL, 4EN, 4XC, 4YA, 5AN, 5BY, 5CI, 5JL, 5KP, 5LA, 5MT, 5NZ, 5XJ, 5XT, 5ZA, 5ZU, 6AAG, 6WV, 6XAD, 6XAE, 6ZA, 6ZT, 7EX, 7ZE, 8AAP, 8AB, 8ABO, 8ACF, 8ACP, 8ADY, 8AGZ, 8AIL, 8AIO, 8AJT, 8AMF, 8ANP, 8AOG, 8APT, 8AQF, 8AQV, 8AQZ, 8ARW, 8ASV, 8AWF, 8AWP, 8BA, 8BD, 8BDU, 8BEF, 8BET, 8BEX, 8BFX, 8BK, 8BNJ, 8BO, 8BOX, 8BOZ, 8BRL, 8BU, 8BUM, 8BXA, 8CAD, 8CF, 8CI, 8DA, 8DR, 8DU, 8DW, 8DX, 8EB, 8FO, 8FU, 8FP, 8GA, 8GV, 8HA, 8IB, 8II, 8IQ, 8IV, 8JL, 8JQ, 8JS, 8KH, 8LX, 8NM, 8NQ, 8OW, 8PA, 8QY, 8TT, 8UJ, 8UK, 8UO, 8VJ, 8VK, 8VR, 8VY, 8WY, 8XK, 8XM, 8XV, 8ZAE, 8ZG, 8ZN, 8ZV, 8ZY, 8ZZ, 9AAP, 9AAO, 9AAS, 9AAU, 9AAU, 9AAV, 9ABU, 9ACB, 9AEJ, 9AEO, 9GN, 9AIO, 9AJA, 9AJH, 9AJP, 9AKB, 9AKD, 9AKR, 9AKX, 9AMA, 9AMB, 9AMF, 9AOG, 9AOS, 9AN, 9AQR, 9ARK, 9ASB, 9ASD, 9ASK, 9AT, 9ATC, 9ATH, 9AUL, 9AVM, 9AVN, 9AWB, 9AWH, 9AWJ, 9AWL, 9AWM, 9AXE, 9AYS, 9AYU, 9BAP, 9BAV, 9BBF, 9BBL, 9BED, 9BEK, 9BEX, 9BFG, 9BHD, 9BHE, 9BHS, 9BIC, 9BKE, 9BLO, 9BNO, 9OFC, 9BC, 9CH, 9CR, 9DCF, 9DCY, 9DGE, 9DKX, 9DOF, 9DOU, 9DPE, 9DQM, 9DTA, 9DTM, 9DTW, 9DV, 9DVA, 9DWI, 9DWJ, 9DWN, 9DY, 9DYU, 9DZQ, 9EA, 9FM, 9FO, 9GK, 9GL, 9GO, 9HK, 9HW, 9HY, 9II, 9JD, 9KX, 9LQ, 9LY, 9NX, 9PN, 9PI, 9PG, 9QE, 9RT, 9RV, 9RZ, 9SV, 9UM, 9VG, 9WD, 9XAC, 9XI, 9XM, 9XU, 9YAC, 9ZAF, 9ZB, 9ZF, 9ZJ, 9ZT, 9ZY.

Spark: Canadian, 3BP, 4BG, 9AW, 2MO, 4DV, 5BC, 5BM, 5BY, 5EJ, 5EK, 5EL, 5ER, 5EW, 5FO, 5FV, 5HK, 5HJ, 5IF, 5IR, 5IS, 5JD, 5KK, 5LB, 5LC, 5MK, 5NC, 5NS, 5OD, 5OF, 5OH, 5OZ, 5PE, 5PG, 5PU, 5QH, 5QI, 5QS, 5RN, 5TU, 5UG, 5UJ, 5UN, 5XA, 5XB, 5XJ, 5XO, 5XS, 5XT, 5XU, 5YM, 5YZ, 5ZA, 5ZAA, 5ZAB, 5ZAG, 5ZAK, 5ZC, 5ZE, 5ZD, 5ZL, 5ZS, 5ZZ, 6LC, 7DH, 1EX, 7FQ, 7GV, 7JL, 7LU, 7LY, 7MP, 7MO, 7MU, 7PI, 7ZO, 7ZS, 7ZU, 7ZV, 8AFB, 8AFD, 8ASZ, 8AYN, 8BDL, 8BEP, 8BLW, 8BRL, 8CB, 8DZ, 8FI, 8GH, 8JJ, 8JQ, 8KP, 8MG, 8MO, 8MI, 8MP, 8MZ, 8NJ, 8OI, 8PT, 8UC, 8TO, 8VJ, 8VR, 8WO, 8YL, 8YM, 8YN, 8YR, 8YU, 8ZA, 8ZF, 8ZP, 8ZN, 8ZU, 8ZY, 9AAC, 9AAP, 9AAW, 9ABY, 9ABY, 9ACB, 9ACL, 9ACM, 9ACN, 9ACY, 9ADI, 9AEG, 9AEH, 9AEY, 9AF, 9AFJ, 9AFW, 9AFX, 9AGH, 9AGN, 9AGR, 9AGU, 9AIF, 9AIG, 9AIH, 9AIJ, 9AIU, 9AJS, 9AKA, 9AKX, 9ALU, 9AMA, 9AMK, 9AMS, 9ANF, 9ANM, 9NO, 9NR, 9ANX, 9AOJ, 9AOU, 9AOW, 9APC, 9APN, 9AQ, 9AQE, 9AQM, 9ARI, 9ARK, 9ARZ, 9ASF, 9ASJ, 9ASK, 9ASL, 9ASN, 9ATN, 9AU, 9AUE, 9AUG, 9AUL, 9AUO, 9AUU, 9AUZ, 9AVC, 9AVE, 9AVK, 9AVP, 9AVR, 9AVS, 9AVZ, 9AWN, 9AWX, 9AWZ, 9AXA, 9AXR, 9AXU, 9AY, 9AYN, 9AYO, 9AYV, 9AYW, 9AZA, 9AZE, 9AZF, 9BCC, 9BDH, 9BDS, 9BFI, 9BGN, 9BGX, 9BHA, 9BJD, 9BKH, 9BP, 9CA, 9CP, 9CS, 9DAG, 9DAT, 9DAP, 9DBU, 9DBV, 9DEH, 9DF, 9DFL, 9DHZ, 9DJX, 9DKQ, 9DKS, 9DKV, 9DLK, 9DLL, 9DLX, 9DMJ, 9DNE, 9DNC, 9DNX, 9DOC, 9DOG, 9DOI, 9DPB, 9DPE, 9DPH, 9DPX, 9DQC, 9DEJ, 9DSB, 9DSN, 9DTN, 9DTC, 9DUG, 9DUD, 9DUI, 9DUL, 9DUM, 9DVM, 9DWB, 9DWJ, 9DWL, 9DWF, 9DWX, 9WY, 9DXM, 9DY, 9DYA, 9DYG, 9DYU, 9DZF, 9DZI, 9EL, 9ET, 9FI, 9FM, 9FN, 9FO, 9FX, 9GC, 9GM, 9GN, 9GO, 9GR, 9GV, 9GX, 9HI, 9HL, 9HM, 9HR, 9HT, 9IF, 9IY, 9JN, 9JQ, 9JW, 9KF, 9KO, 9KS, 9LA, 9LF, 9LU, 9LW, 9MC, 9ME, 9MF, 9MO, 9MS, 9NO, 9NR, 9OA, 9OO, 9OX, 9PB, 9PI, 9PL, 9PN, 9PS, 9RC, 9RH, 9RP, 9RY, 9RZ, 9SY, 9TI, 9TL, 9TO, 9TV, 9UG, 9UI, 9UU, 9VL, 9WI, 9WS, 9WT, 9XAG, 9XI, 9XM, 9XT, 9YA, 9YAC, 9YAE, 9YAK, 9YM, 9YO, 9ZAC, 9ZB, 9ZC, 9ZJ, 9ZN, 9ZU.

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Batteries. And when you "buy Burgess" you get high capacity and the lowest price in hours of service.

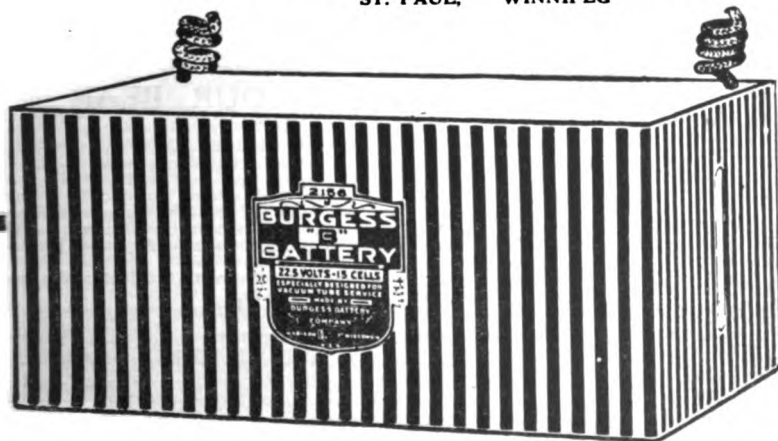
Multi-stage radio frequency and audio frequency amplification is easily possible with the Burgess "B". Weak and distant audio frequency signals can be received with multi-stage amplifiers and Burgess "B" Batteries, because Burgess Batteries do not drown out the signals.

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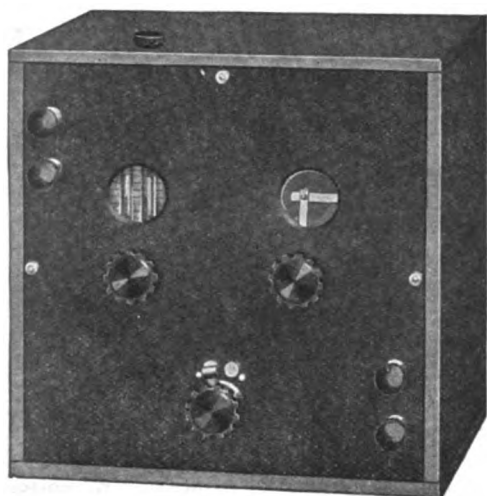
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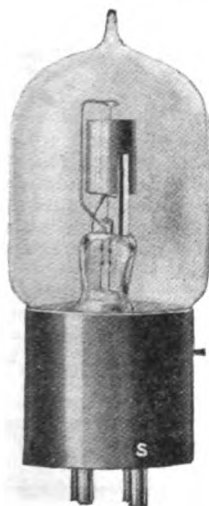
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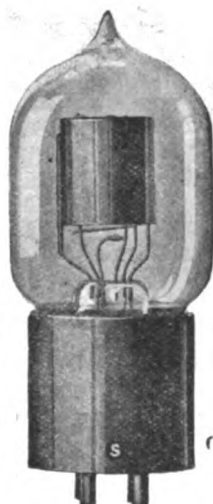
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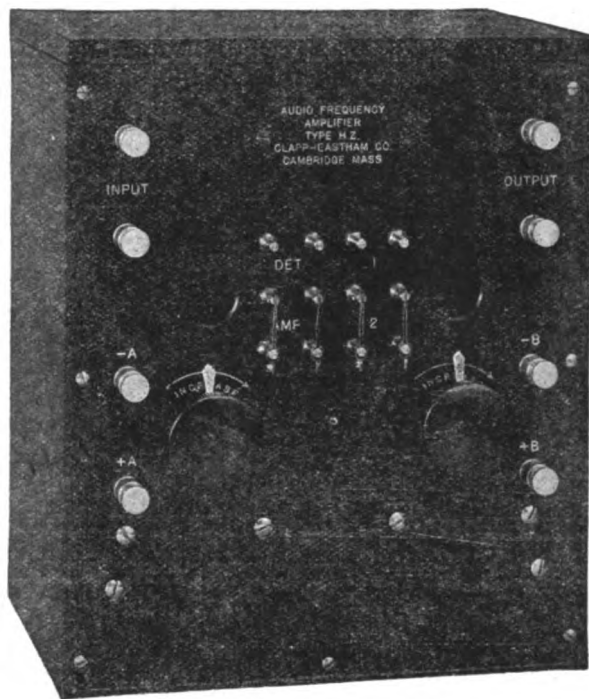
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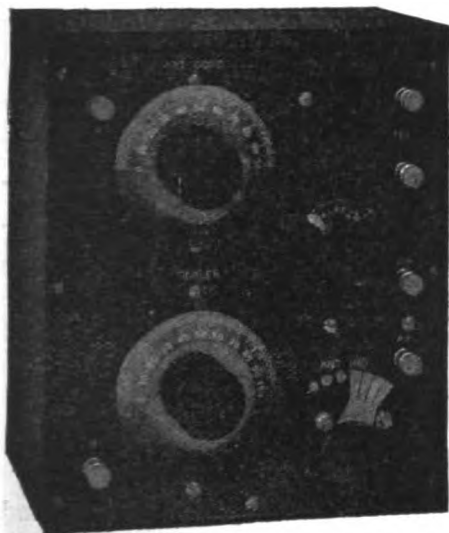
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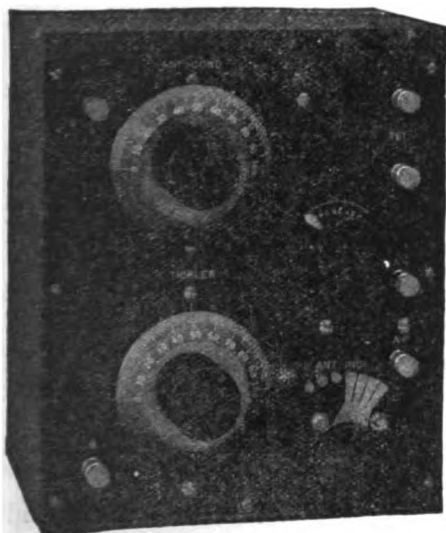
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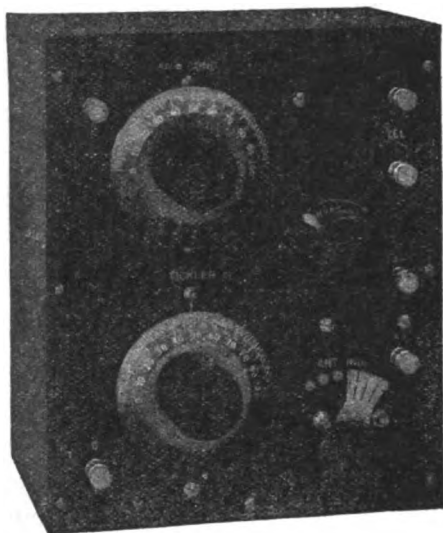
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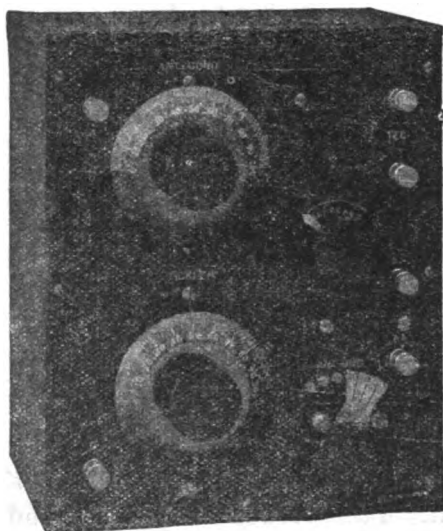
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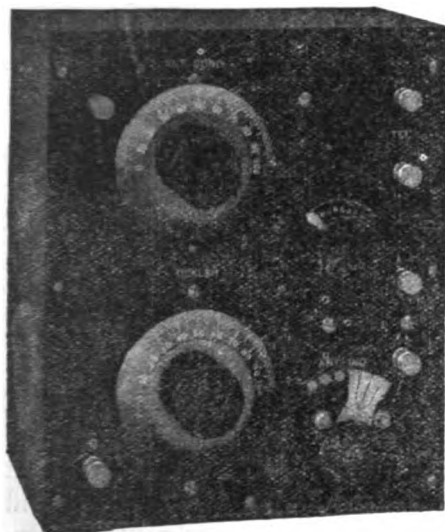
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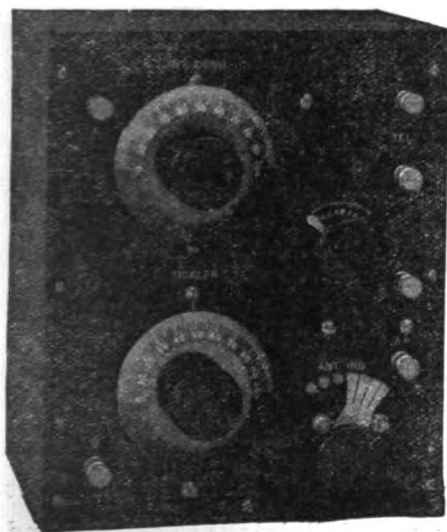
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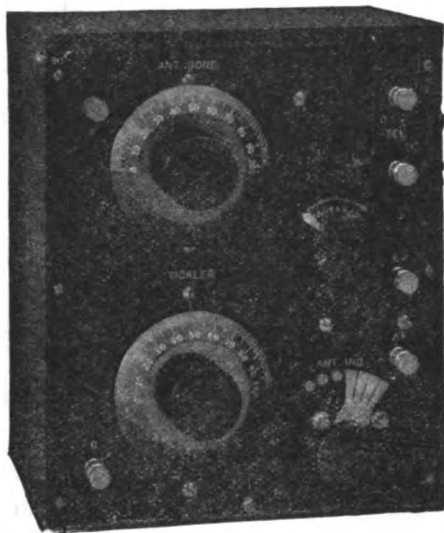
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by mail. Full details of this set and  
complete line of other radio equip-  
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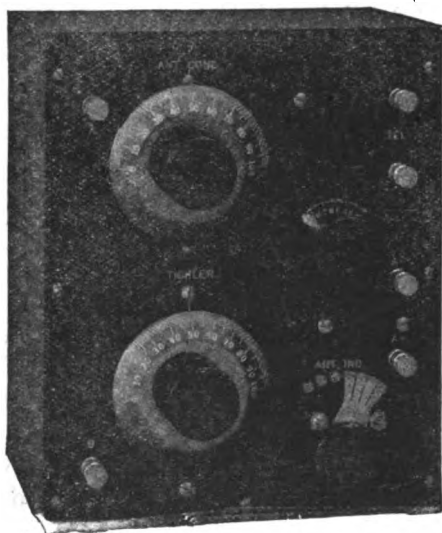
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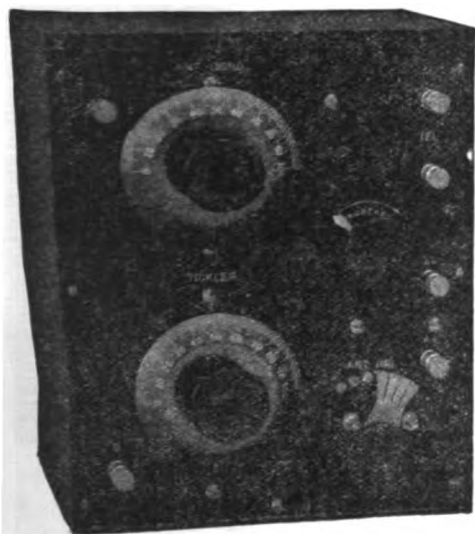
**\$35.00**

**Buys this Set**

Includes tube socket and rheostat. Wired ready for use. A set you will be proud of.

**See this Set in  
WATERBURY, CONN.**

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.



**Clapp-Eastham Type HR Regenerative Receiver. Wave Length 180 to 825 meters.**

**Whitall Electric Co., 59 West Main St., Waterbury, Conn.**

**Wired  
Ready for Use**

This set is complete when you get it. Includes tube socket and rheostat. Wired ready for use.

**See this Set in  
NEW YORK**

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

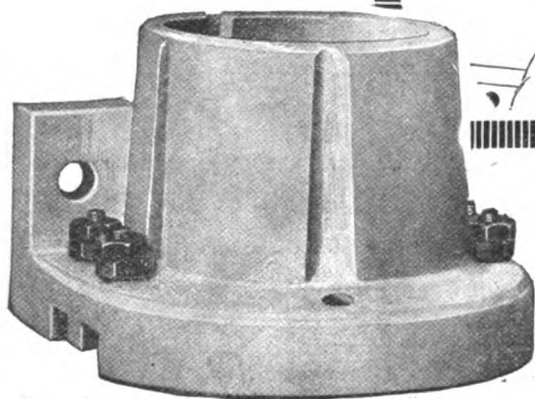


**Clapp-Eastham Type HR Regenerative Receiver. Wave Length 180 to 825 meters.**

**Continental Radio & Electric Corp., 6 Warren St., New York City**

# CROSLEY

## V-T SOCKET



PRICE

60¢

*Better—  
Costs Less*

Yes, it has made a wonderful hit—without doubt the biggest selling Socket on the market today. There are good reasons why. Here are some of them.

It is made for both base and panel mounting. Entirely of porcelain. The bayonet catch is now imbedded in a wall unbreakable. Being made of porcelain a soldering iron will not melt it and it can be used for power tube work without melting.

Its design eliminates possibility of short circuiting filament across high voltage B Battery.

Practically every leading jobber and dealer of radio supplies is handling the CROSLEY V-T SOCKET, because of its great popularity and demand.

We make no apologies for the price. Large production makes it possible. Every one says "The CROSLEY V-T SOCKET is "Better and Costs Less".

Buy from your Dealer. He has it or can get it for you.

*To the few Jobbers and Dealers who are not handling the CROSLEY V-T SOCKET, we make the suggestion to get in line.*

# CROSLEY MANUFACTURING COMPANY

Radio Dept. Q-7,

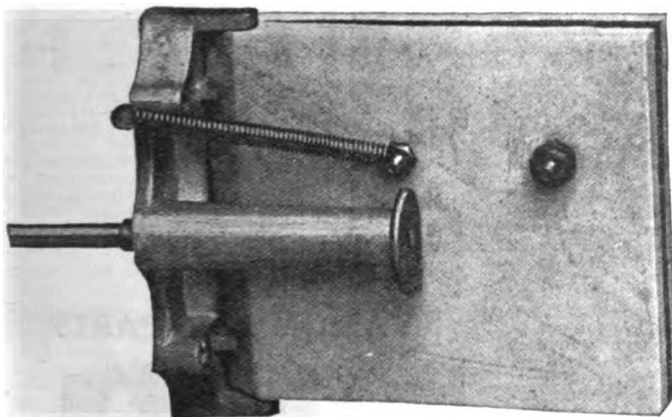
Cincinnati, Ohio

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

# A New CROSLEY Variable Condenser

## Model "C"

The tremendous popularity of the Model "A" CROSLEY VARIABLE CONDENSER, radical as it is, has made possible the promised new model illustrated here. Note the porcelain plates and the die cast frame. Its attractive appearance as well as its efficiency makes it an addition to any set.



Model "B"

This Model is the same as the Model "A" excepting that it has a die cast frame as shown on the illustration above of the Model "A" Condenser. The plates are of laminated wood instead of porcelain. The maximum capacity is conservatively rated at .0005 Mf. None are shipped, however, that test below .0008 Mf. The only difference between it and the Model "A" is the die cast frame. The plates are the same.

Price, unmounted .....\$1.75  
Same with knob and dial ..... 2.25  
Same with knob and dial mounted in mahogany finished cabinet .. 3.00

## Model "A" Crosley Variable Condenser

This instrument needs no introduction to most of the readers. Thousands have been sold on our GUARANTEE of absolute satisfaction or money refunded.

This instrument on large quantity production is better than ever and is highly recommended for any one wishing a condenser with a capacity of .0005 Mf. This Condenser is illustrated herewith.

Note that the frame is made of wood which is not in any way objectionable. Some people, however, prefer the Model "B" with the die cast frame.

The price of the Model "A" as illustrated, without knob and dial .....\$1.25

Same with knob and dial ..... 1.75  
Same with knob and dial, mounted in mahogany finished cabinet 2.50



Model "A" Crosley Variable Condenser

Many Jobbers and Dealers are handling the CROSLEY VARIABLE CONDENSER. If yours does not, send order direct, send us his name and address and we will ship prepaid.

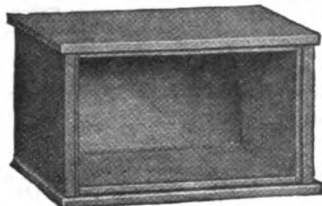
**CROSLEY MANUFACTURING COMPANY**  
RADIO DEPT. Q-7 CINCINNATI, OHIO



# --More CROSELY RADIO APPARATUS

"Better--Costs Less"

## Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various

sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbited in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finished. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

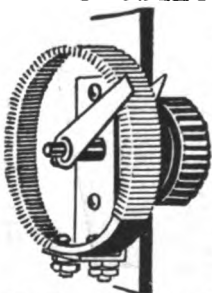
| Panel Size | CABINETS Inside Dimensions |         |      | Mahogany or Quartered |        |
|------------|----------------------------|---------|------|-----------------------|--------|
|            | High                       | Wide    | Deep | Gum                   | Oak    |
| 6x7        | 5 1/2"                     | 6 1/2"  | 7"   | \$2.50                | \$3.85 |
| 6x10 1/2   | 5 1/2"                     | 10"     | 7"   | 2.75                  | 4.40   |
| 6x14       | 5 1/2"                     | 13 1/2" | 7"   | 3.30                  | 5.55   |
| 6x21       | 5 1/2"                     | 20 1/2" | 7"   | 3.90                  | 7.30   |
| 9x14       | 8 1/2"                     | 13 1/2" | 10"  | 3.70                  | 6.80   |
| 12x14      | 11 1/2"                    | 13 1/2" | 10"  | 4.40                  | 6.80   |
| 12x21      | 11 1/2"                    | 20 1/2" | 10"  | 5.25                  | 10.60  |

Cash must accompany order. No C.O.D.'s. We pay transportation charges.

## FORMICA PANELS

We can furnish genuine formica panels 1/8" thick, cut to the following dimensions: 6x7; 6x10 1/2; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2 1/2¢ per square inch. For odd sizes order the next largest size; we will trim. We pay postage.

## CROSELY RHEOSTATS



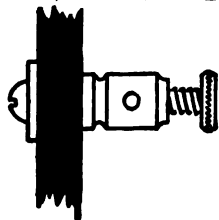
Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including 3/4"; non-corrosive resistance wire.

Model "A"—overall diameter 1 5/8". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60¢ each.

Model "B"—Resistance 4 ohms; will carry 3 amperes without heating. Suitable for detector, where very

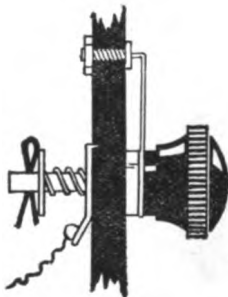
accurate adjustment is required and for 5 watt power tubes. Price \$1.25.

## CROSELY BINDING POSTS



Barrel 3/4"x1 1/2". Not too small nor too large, just the right size.

Nickel plated. Complete with base screw and washer as illustrated. Price, 8¢ each or 90¢ per dozen.



## CROSELY TAP SWITCHES

Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible bus wire connection. Price 10¢ each. Better--Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut, 8¢ each, 80¢ per dozen or \$2.50 per hundred.

## CROSELY VARIOMETER PARTS



This set consist of two stators, one rotor, the necessary hardware shown in the illustration. Shaft for knob and dial is 1/8" diameter. The wood parts are furnished either in poplar or mahogany.

The average radio man has his own ideas about the kind of wire and the number of turns that he wishes to use, depending upon its purpose, so we leave that to the purchaser. The operation of winding and setting up is very simple, but the parts that we list are difficult for the amateur to make. They are made in our own large wood working plant on special automatic machinery that make possible very accurate quantity production.

Price of Variometer parts, described above, made of poplar wood, is \$1.50 (including wood parts and hardware).

If wood parts are made of mahogany \$1.75.

If winding form is desired, it can be used for winding one or more variometers. Price is 30¢ additional.

## CROSELY VARIOCOUPERS



CROSELY VARIOCOUPERS consist of formica tube, rotor and brass hardware. It is made with the same care and accuracy as the CROSELY VARIOMETER.

Price, complete as shown in the illustration, not wound or assembled, \$1.50. Stator, only, 40¢.

If your dealer does not handle any of the above parts, you may order direct. We will ship prepaid.

Dealers and Distributors: Every item shown above should be in your stock. Write for proposition.

**Crosley Manufacturing Company**  
Radio Dept. Q-7,  
Cincinnati, Ohio

# CROSLY RADIO UNITS

*"Better--Cost Less"*

## HARKO RADIO RECEIVER



The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire.

Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati. 20 watt Radiophone copied 25 miles with addition of the Crosley Variable Condenser in series with antenna. Radiophone copied five to ten miles without condenser.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. \$9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. \$6.00 extra. Complete outfit \$15.00. If your dealer cannot furnish, we will ship direct prepaid.

## HARKO SENIOR RADIO RECEIVER



Here is a complete tuner and audio detector assembled on a formica or other high grade dielectric panel, mounted complete in mahogany finished cabinet. This New Jersey

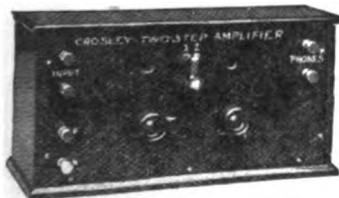
instrument gives wonderful results. phones, music and voice; KDKA, ships at sea, amateur and other signals for hundreds of miles copied in Cincinnati on detector only.

In combination with the CROSLY TWO STEP AMPLIFIER the HARKO SENIOR brings phones in all over the house. Range, 150 to 600 meters, non-regenerative hook-up.

Satisfaction GUARANTEED or money refunded as on all CROSLY apparatus.

Size 11 1/2 in. long, 4 1/4 in. deep and 6 in. high. Consists of condenser, tapped inductance, socket, rheostat, etc., completely wired assembled and tested, without battery, tube or phones. Price \$16.00

## CROSLY TWO STEP AMPLIFIER



This instrument was designed to give the very maximum in value—to match up with the HARKO SENIOR, using the same sized cabinet. Complete with amplifying transformers, sockets, rheostats, switch, binding posts, etc., mounted on formica panel in mahogany finished cabinet.

This instrument can be used not only with the HARKO SENIOR but with any other apparatus requiring two step amplifier.

Price, complete as shown in the illustration \$25.00

## CROSLY DETECTOR UNITS

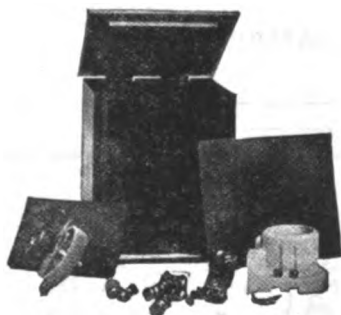


There are furnished in two ways:

Completely wired and mounted as shown on the left, or knocked down as shown on the right. Mounted—everything ready to hook to your set. Suitable for many different hook-ups. Formica panel: mahogany finished cabinet. Matches up with the CROSLY TWO STEP AMPLIFIER.

Price, completely assembled, as shown on the left.....\$7.50

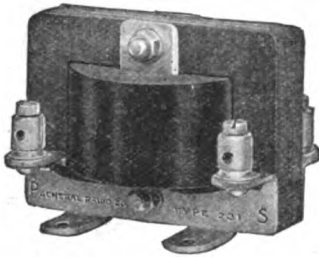
Price of all parts, including formica or other panel of high grade dielectric composition, not drilled as shown on the right.....6.00



Size of the cabinet is 5 1/2 in. long, 4 1/4 in. deep and 6 in. high. If your dealer cannot furnish any of the above units, we will ship direct prepaid, at the price. Dealers: Do not overlook the sales possibilities of the above units. Write for proposition.

**CROSLY MANUFACTURING COMPANY**  
Radio Dept. Q-7, Cincinnati, Ohio

# Amplification Without Distortion



**Type 231A Transformer**

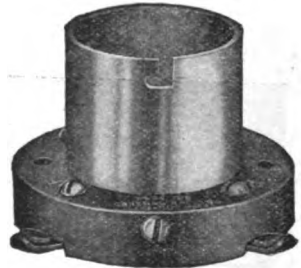
An amplifying transformer could be made to sell for \$1.00. It would amplify, too. An amplifying transformer could be made costing hundreds of dollars. It would amplify much more satisfactorily than the dollar transformer. Both of these cases are extremes, but somewhere in between is a transformer which has the correct number of turns and the correct core dimensions, yet which has no unessential parts unnecessarily increasing its cost.

Our Type 231-A amplifying transformer was constructed as the result of extended engineering study to obtain a transformer when used with a Radiotron UV201 tube would give the maximum amplification of signals without distortion. To accomplish this, the winding is correctly designed both in regard to turn ratio and the method of winding. The winding is such that the distributed capacity is kept a minimum so that telephone signals will not be distorted, and at the same time is rugged mechanically so that open circuits will not occur. The core is such that saturation will not occur causing signal distortion and also is so designed that eddy currents will be reduced to a minimum.

Multi-stage, audio frequency amplification is neither necessary nor desirable for ordinary work. Two stages of amplification with properly designed transformers is all that should be required. Why not use a transformer which will give you all the amplification necessary in one or two stages?

**PRICE - COMPLETELY MOUNTED - \$5.00**

A vacuum tube socket plays an important part in amplification. The prongs of the tube must make perfect contact to prevent the introduction of noises. The springs in our Type 156 vacuum tube socket are so arranged that contact noises are entirely eliminated.



**Type 156 Socket**

**Rugged Attractive Reliable**  
**PRICE \$1.50**

Send for Free Radio Bulletin 910Q

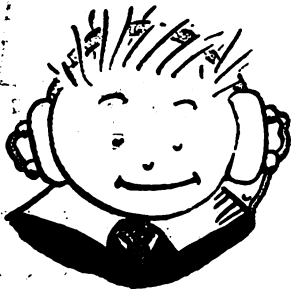
**GENERAL RADIO COMPANY**

MASSACHUSETTS AVENUE AND WINDSOR STREET

**CAMBRIDGE, 39,**

**MASSACHUSETTS**

*Standardize on General Radio Equipment Throughout.*



**Read the "DIARY OF A HAM"**

Appearing Each Month in

**"CANADIAN WIRELESS"**

(ONE DOLLAR A YEAR)

**Scientific Experimenter**

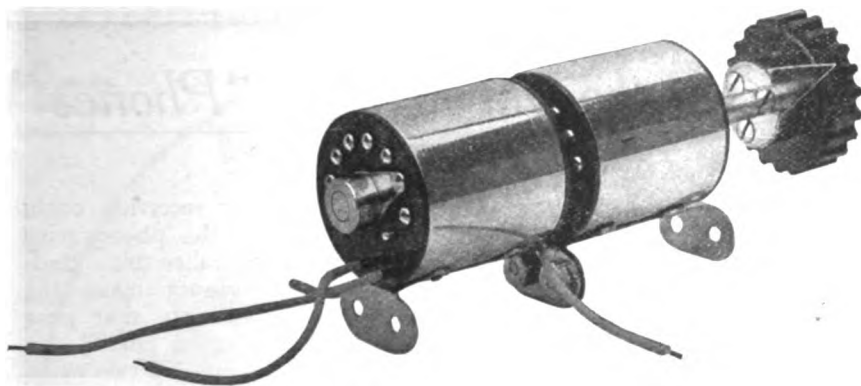
LIMITED

**33 McGill College Avenue,**

Write for Catalog of Wireless Supplies

**Montreal, P. Q.**

# Radio Frequency Amplifier



Pat. Appl. For

There is nothing that opens up a wider field on the receiving end for the amateur and experimenter, than radio frequency amplification.

After an extensive investigation of the various types of tube couplings possible for radio frequency amplification, we have developed the above units (two are shown) with a view to giving maximum efficiency and greatest ease of control, at a reasonable price.

Tuning each stage is not necessary. Only one adjustment necessary to cover fairly wide bands of wave-lengths with several stages.

Transformers for several stages can be mounted in tandem with single control which greatly simplifies the manipulation of the set.

Remember that radio frequency amplification will increase the range, the selectivity and the satisfaction you can get from your receiver. A loop antenna will be far more effective with radio frequency amplification.

These units will cover wave-lengths from 180 to 750 meters.

**TYPE 5000 RADIO FREQUENCY AMPLIFYING TRANSFORMERS,**  
**\$5.50**

## COTO-COIL CO.

87 WILLARD AVE.,  
PROVIDENCE, R. I.

THE FOLLOWING DEALERS CARRY OUR APPARATUS—CALL IN AND SEE THEM

**SOMERVILLE RADIO LABORATORY**  
Somerville, Mass.  
**WHITEHALL ELECTRIC CO.**  
Waterbury, Conn.  
**R. I. ELECTRICAL EQUIPMENT CO.**  
Providence, R. I.  
**DELANCEY FELCH & CO.**  
Pawtucket, R. I.  
**CONTINENTAL RADIO AND ELECTRIC CO.**  
New York, N. Y.  
**THE SAUTER CO.,**  
Schenectady, N. Y.  
**THE CRAMER HARDWARE CO.,**  
North Tonawanda, N. Y.  
**HUGHES ELECTRIC CORP.,**  
Syracuse, N. Y.  
**STERLING HARDWARE & ELECTRIC CO.,**  
Jamestown, N. Y.  
**RUSSELL MFG. CO.,**  
Niagara Falls, N. Y.  
**RADIO SUPPLY SERVICE,**  
Mount Vernon, N. Y.  
**JATH WIRELESS CO.,**  
Buffalo, N. Y.  
**RADIO ELECTRIC CO.,**  
Pittsburgh, Pa.  
**LANCASTER ELEC. SUPPLY & CON. CO.,**  
Lancaster, Pa.  
**R. SELWAY COLLUMS,**  
Baltimore, Md.  
**JONES ELECT. & RADIO MFG. CO.,**  
Baltimore, Md.  
**WHITE & BOYER CO.,**  
Washington, D. C.  
**CARTER ELECTRIC CO.,**  
Atlanta, Ga.  
**HERBRICK & LAWRENCE,**  
Nashville, Tenn.

**SMITH NOVOTOY ELEC. CO.,**  
Charlotte, N. C.  
**NOLA RADIO CO.,**  
New Orleans, La.  
**JULIUS ANDRAE & SONS CO.,**  
Milwaukee, Wis.  
**INDUSTRIAL RADIO SERVICE,**  
Saginaw, Mich.  
**DETROIT ELECTRIC CO.,**  
Detroit, Mich.  
**WM. HALL ELECTRIC CO.,**  
Dayton, Ohio  
**SALZER ELECTRIC CO.,**  
Cleveland, Ohio.  
**WIRELESS MFG. CO.,**  
Canton, Ohio.  
**MARSHALL-GERKEN CO.,**  
Toledo, Ohio.  
**PRECISION EQUIPMENT CO.,**  
Cincinnati, Ohio  
**RADIOELECTRIC SHOP CO.,**  
Cleveland, Ohio.  
**SCIENTIFIC ENGINEERING CO.,**  
Cincinnati, Ohio  
**DODGE'S RADIO INSTITUTE,**  
Valparaiso, Ind.  
**TELEPHONE MAINTENANCE CO.,**  
Chicago, Ill.  
**WESTERN RADIO CO.,**  
Kansas City, Mo.  
**WESTERN RADIO ELECTRIC CO.,**  
Los Angeles, Cal.  
**ALTADENA RADIO LABORATORY,**  
Altadena, Cal.  
**SCIENTIFIC EXPERIMENTER, LTD.,**  
Montreal, Canada.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

## Give a thought to your "Phones"



"Superior"—2,000 Ohms, weight 14 oz., complete with head band and polarity indicating cord \$8.

The efficiency of any receiving outfit is determined largely by the 'phones used with it. Few amateurs realize this. Badly designed 'phones cannot make the most of the feeble currents that pass through them. It is often possible to multiply receiving efficiency by two when Brandes headsets are used. Actions speak louder than words. Ask your dealer about our ten-day trial offer or write direct.

Brandes are used as *standard* equipment by the leading manufacturers.

You will be interested in our literature. It tells you something that you do not know about 'phones.

### **C. Brandes, Inc.**

**Room 821, 32 Union Square, New York City**

*Member Radio Section Associated Manufacturers of Electrical Supplies.*

# BRANDES Matched-Tone HEADSETS

## **ACME AMPLIFYING**

## **TRANSFORMER**

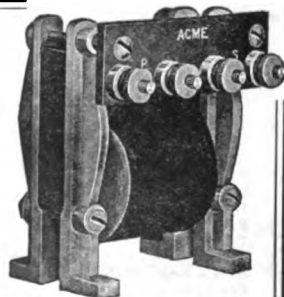
**\$5.00**

**The Heart of Any Amplifier.  
Can't Be Beat.**

Carried in Stock by Leading Dealers.  
*Write for bulletins.*

**ACME APPARATUS COMPANY,**

**NEW YORK SALES OFFICE: 1270 BROADWAY**



194 MASSACHUSETTS AVE.  
CAMBRIDGE 39, MASS.

**ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS**

Price

\$6<sup>00</sup>

TYPE 500  
BAKELITE MOLDED  
**Variometer**

TYPE 501  
WITH BAKELITE  
DIAL AND KNOB  
\$7<sup>00</sup>



There is a  
guarantee with  
every Remler item

Electrically  
and Mechanically  
without equal

OVER ALL HEIGHT 5 3/4"  
STATOR WIDTH 3"  
MAX. ROTOR DIA. 4"

## Remler Quality Throughout

Remler Type 500 Bakelite Molded Variometer .....\$6.00  
Remler Type 501 with No. 100 Bakelite Dial and Knob .....\$7.00

Stator moulded in two halves from genuine Bakelite with primary winding moulded on the inside, insuring an absolutely rigid winding. Rotor also moulded from Bakelite. This all Bakelite moulded construction insures accurate mechanical dimensions, strength and precludes the possibility of warping or shrinkage. Large dimensions permit the use of low resistance windings. Maximum stator diameter 5 3/4"; maximum rotor diameter 4"; width across stator 3"; shaft 1/4" diameter. Bearings backed up with spring tension. Wave length range 175-500 meters. Stator drilled and tapped for panel mounting. Brackets for table mounting. Polished nickel binding post terminals.

Write for 32 page Remler Bulletin—just off the press.

## REMLER RADIO MFG. CO.

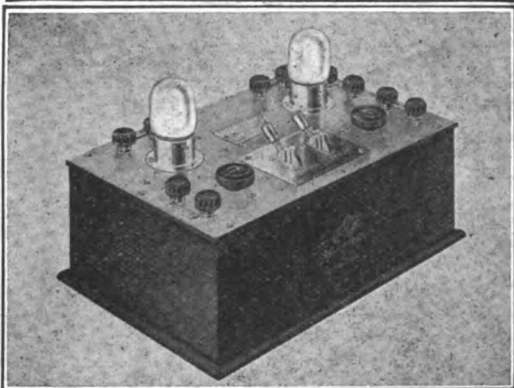
E. T. Cunningham, Gen. Mgr.

248 First Street  
San Francisco, Calif.

154 West Lake Street  
Chicago, Illinois



# RADIO MAGNAVOX



No set complete without one

## Power Amplifiers

The new MAGNAVOX Power Amplifiers are designed especially for use with the Radio MAGNAVOX to insure the MAGNAVOX receiving the largest possible power input for volume reproduction. They also increase tone clearness and distinctness because they do not distort the impulses before such impulses reach the MAGNAVOX. Can be used with transmitting tubes with from 100 to 500 volts on plates.

Type AC-3 Model C, 3-stage, a beautiful instrument, in a solid mahogany case, with master switches, sits either flat or on end—price \$110.

Type AC-2 Model C—same as above only 2-stage—price \$80.

Sold thru dealers. See yours today

Dealers  
write for  
proposition



REG. U.S.  
PAT. OFF.

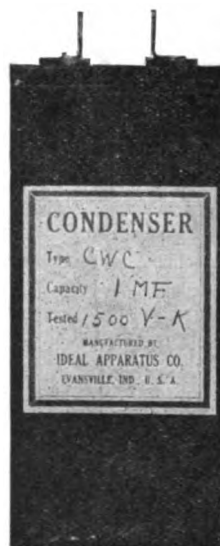
# THE MAGNAVOX CO.

GENERAL OFFICES & FACTORY  
OAKLAND, CALIFORNIA

NEW YORK OFFICES  
370 SEVENTH AVE. PENN. TERMINAL BLDG.

# I D E A L

## FILTER CONDENSER



Type ICC

The Ideal Condensers have met with great favor in radio circles throughout the country, all because of their super-efficiency.

Recently designed to stand potentials of 2000 Volts without puncturing, and at no increase in price.

These attractively priced condensers may be obtained from any of the dealers listed below. They will furnish you with complete information regarding the IDEAL LINE.

1 Mfd 2000 Volt Condenser .... \$2.00  
2 Mfd 500 Volt Condenser .... 1.50

Somerville Radio Lab., Boston, Mass.  
Benwood Company, Inc., St. Louis, Mo.  
Pitt. Radio & Appli. Co., Pitts., Pa.  
Hemple Electric Co., Omaha, Nebr.  
Klaus Radio Co., Eureka, Ill.  
Standard Radio Co., Los Angeles, Calif.  
Nola Radio Co., New Orleans, La.  
John R. Koch, Charleston, W. Va.  
Cino Radio Mfg. Co., Cincinnati, O.  
T & H Radio Company, Anthony, Kansas  
Wireless Mfg. Co., Canton, Ohio  
Northern Radio Co., Seattle, Wash.

C-W CATALOG FREE  
IDEAL APPARATUS COMPANY  
EVANSVILLE,

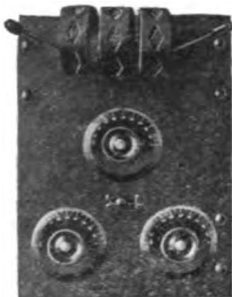
"9XAH"

INDIANA

"9XAH"

# Type "Q" Receiver

**AN IDEAL RECEIVING SET FOR LONG  
AND SHORT WAVE AND RADIO  
TELEPHONE RECEPTION**



This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

**Price without Detector.....\$35.00**

## Duck's New Radio Catalog No. 16



Send 12c today for copy of the greatest radio catalog ever put between the pages of two covers.

### **275 Pages--A Catalog DeLuxe**

Never in the history of radio was such a catalog printed.

The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many text books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

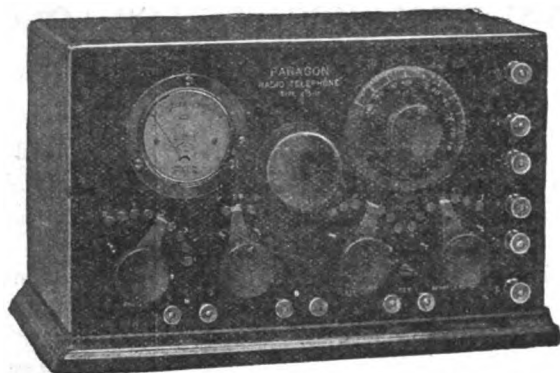
Send only 12c for copy of this wonderful catalog. You will need no other when you have Duck's, and you cannot find in all others combined what you will find in Duck's Wonder Catalog.

## The William B. Duck Company

**243-245 Superior Street**

**Toledo, Ohio**

# PARAGON



**PARAGON RADIO TELEPHONE TYPE 2-5-U**  
(Licensed under Armstrong Patents) (Patents Pending)

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**Phone:** Babylon, N. Y. to Ocean City, N. J. daylight (10 A.M.)  
125 miles 2 5 watt tubes.

**CW and Buzzer:** (1 5 watt tube)  
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Highly Efficient; remarkably flexible; voice, buzzer, or CW; instantaneous access to 7 wave lengths; a perfect "short haul" universal transmitter that's delightfully effective.

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### Impedance Values at 1000 Cycles

**Primary with Secondary Open**  
36,175 ohms

**Primary with Secondary Shorted**  
1,875 ohms

**Secondary with Primary Open**  
1,875,000 ohms

**Secondary with Primary Shorted**  
55,000 ohms

An instrument that will make you proud of your Radio Station.

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**CHELSEA RADIO COMPANY**

**150 FIFTH STREET,**

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**THE ALAMO RADIO ELEC. CO.**  
608 West Evergreen St., San Antonio, Texas  
**STANDARD PRICES—SERVICE**

SEND US YOUR ORDERS TODAY. FULL LINE OF RADIO EQUIPMENT. WE CARRY ALL POPULAR MAKES—BATTERIES, TUBES, SWITCHES, REGENERATIVE RECEIVERS, ETC. **NOTICE:- BALDWIN PHONES.**

# DO YOU KNOW?

**THAT YOU CAN SAVE MONEY  
YOU CAN GET REAL SERVICE  
YOU CAN SAVE MUCH TIME**

**BY**

**SEND FOR THE  
RADIO CORPORATION  
Book of CW  
INSTRUCTION \$0.25**

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|                               |        |
|-------------------------------|--------|
| No. UV200 Radiotron detector  | \$5.00 |
| No. UV201 Radiotron Amplifier | 6.50   |
| No. UV202 Radiotron 5 watt    | 6.00   |
| No. UV203 Radiotron 50 watt   | 30.00  |
| No. AP Amplifier oscillator   | 6.50   |

### B BATTERIES

|                                    |      |
|------------------------------------|------|
| No. 766 Eveready 22½ volt variable | 3.00 |
| No. 774 Eveready 43 volt variable  | 4.50 |
| No. 765 Eveready 22½ volt          | 2.00 |

### REGENERATIVE RECEIVERS

|   |        |
|---|--------|
| No. CR-3 Grebe Relay-special 175-680 meters                                   | 65.00  |
| No. CR-5 Grebe super-special 175-3000 meters with detector complete           | 80.00  |
| No. CR-8 Grebe 175-1000 meters with detector latest type short wave set       | 80.00  |
| No. CR-9 Grebe 175-3000 meters complete with det. & 2 stage amplifier         | 130.00 |
| No. CR-6 Grebe 175-680 meters with det. and 2 stage amp. phone & series cond. | 160.00 |
| No. RA Westinghouse 170-700 meters  | 65.00  |

### PLUGS

|                              |      |
|------------------------------|------|
| No. 50 Pacant universal type | 2.00 |
| No. 34a Firco flat type      | 2.00 |
| No. 35b Firco Round type     | 2.50 |
| No. 1428-W Federal brass     | 2.00 |

### JACKS

|                                      |      |
|--------------------------------------|------|
| No. 1422-W Federal closed circuit    | .85  |
| No. 1423-W Federal two circuit       | 1.00 |
| No. 1435-W Federal automatic control | 1.20 |
| No. 1436-W Federal automatic control | 1.50 |

### RECEIVING SETS (Crystal)

|                                    |       |
|------------------------------------|-------|
| Westinghouse "Aeriola" with phones | 25.00 |
| DeForest crystal receiver          | 25.00 |

### TELEPHONES

|                                       |       |
|---------------------------------------|-------|
| No. 56 Murdock 2000 ohm               | 5.00  |
| No. 56 Murdock 3000 ohm               | 6.00  |
| No. C Baldwins                        | 12.00 |
| No. E Baldwins                        | 13.00 |
| No. F Baldwins                        | 14.00 |
| No. G Baldwins new style static-proof | 15.00 |
| No. C Baldwins single unit only       | 6.00  |
| No. Brandes "Superior" type           | 8.00  |
| No. Brandes "Transatlantic" type      | 12.00 |
| No. Brandes "Navy" type               | 14.00 |

### BOOKS

|   |      |
|---|------|
| Practical Wireless Tel. by Bucher       | 2.25 |
| Wireless Experimenters Manual by Bucher | 2.25 |
| How to pass US Govt. exams by Bucher    | .75  |
| How to conduct a radio club by Bucher   | .75  |
| Practical amateur stations by Bucher    | .75  |
| Radio Corporation CW Instruction        | .25  |

### VARIOMETERS

|                                 |        |
|---------------------------------|--------|
| No. 500 Remler moulded          | \$6.00 |
| No. 501 Remler with dial & knob | 7.00   |
| No. 1 Tuska moulded type        | 6.25   |
| No. 2 Tuska with dial moulded   | 7.50   |
| No. ZRV Clapp-Eastham with dial | 6.50   |
| No. Amrad with knob & dial      | 6.10   |

### VARIO-COUPERS

|                                 |      |
|---------------------------------|------|
| No. 503 Remler moulded type     | 5.40 |
| No. 2163 Amrad with dial        | 6.90 |
| No. 3 Tuska moulded with dial   | 5.50 |
| No. ZRV Clapp-Eastham with dial | 7.50 |

### AMPLIFIERS

|                                    |       |
|------------------------------------|-------|
| No. RORC Grebe 2 stage             | 55.00 |
| No. RORD Grebe det. & 2 stage      | 75.00 |
| No. 333 Remler 1 stage             | 9.00  |
| No. DA Westinghouse det. & 2 stage | 65.00 |

### LOOSE COUPLERS

|                                     |       |
|-------------------------------------|-------|
| No. 344 Murdock 1500 meters         | 9.00  |
| No. F-473 Clapp-Eastham 3000 meters | 14.00 |

### LOUD SPEAKERS

|                               |       |
|-------------------------------|-------|
| No. R-3 Magnavox new model    | 45.00 |
| No. Vocalund station type     | 30.00 |
| No. 400-W Federal "Telephone" | 14.00 |

### CONDENSERS (variable)

|  |      |
|--|------|
| No. 1500 Wireless Shop .0004 mfd.        | 6.00 |
| No. 2500 Wireless Shop .0005 mfd.        | 7.50 |
| No. 3500 Wireless Shop .0008 mfd.        | 9.00 |
| No. CV-500 DeForest .0005 mfd.           | 4.75 |
| No. CV-500 DeForest Knockdown .0005 mfd. | 3.00 |
| No. 3540 Murdock mounted .001 mfd.       | 4.00 |
| No. 367 Murdock mounted .0005 mfd.       | 3.75 |

### CONDENSERS (fixed mica)

|  |      |
|--|------|
| No. 577 Dubilier all capacities                        | 2.00 |
| No. UC1014 Radia Corp. .002 mfd.                       | 2.00 |
| No. UC1015 Radia Corp. .0003, .0004, .0005, 7500 volts | 5.40 |
| No. ROCC Grebe .0002 mfd. 1000 volts                   | 1.00 |
| No. ROCD Grebe .0005 mfd. 1000 volts                   | 1.20 |
| No. ROCF Grebe .005 mfd. 1000 volts                    | 3.80 |

### COILS (duo-lateral)

|        |        |         |        |
|--------|--------|---------|--------|
| DL-25  | \$1.40 | DL-300  | \$1.75 |
| DL-35  | 1.40   | DL-400  | 1.80   |
| DL-50  | 1.45   | DL-500  | 2.00   |
| DL-75  | 1.50   | DL-600  | 2.15   |
| DL-100 | 1.55   | DL-750  | 2.30   |
| DL-150 | 1.60   | DL-1000 | 2.55   |
| DL-200 | 1.65   | DL-1250 | 3.00   |
| DL-250 | 1.70   | DL-1500 | 3.45   |

### COIL MOUNTINGS

|  |      |
|--|------|
| No. 400 Remler 3 coil mounting         | 6.90 |
| No. ULC-100 DeForest 3 coil with gears | 8.50 |

**WE HAVE ALL STANDARD MAKES OF APPARATUS OR PARTS  
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phones 2200  
ohm ..... \$8.00

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| Rheostats Paragon .....                | 1.50        |
| Rheostats Fada .....                   | 1.00        |
| Rheostats General Radio .....          | 2.50        |
| Federal Jacks .....                    | \$0.70-1.50 |
| Universal Plugs .....                  | 1.75        |
| Federal Plug (Brass) .....             | 2.00        |
| Baldwin Phones Type C .....            | 12.00       |
| Federal Phones 2200 Ohms .....         | 8.00        |
| Federal Phones 3200 Ohms .....         | 10.50       |
| Murdock Phones 55-2000 Ohms .....      | 4.50        |
| Murdock Phones 55-3000 Ohms .....      | 5.50        |
| Murdock Phones 55-2000 Ohms .....      | 5.00        |
| Murdock Phones 55-3000 Ohms .....      | 6.00        |

|   |       |
|---|-------|
| Chelsea Condenser #1 mounted .....      | 5.00  |
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| Chelsea Condenser #3 unmounted .....    | 4.75  |
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| Westinghouse Detector 2 stage-D.A. .... | 68.00 |
| Westinghouse Areola Jr. Receiver .....  | 25.00 |
| Westinghouse Areola Sr. Receiver .....  | 75.00 |
| Federal Detector & 1 Stage Amp. ....    | 52.00 |
| Federal 2 Stage Amplifier .....         | 58.00 |
| Federal Transformer .....               | 7.00  |
| Tuska Variometers 200 .....             | 7.25  |
| Radio Corp. Potentiometer .....         | 2.00  |
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| DeForest LC100 Coil Mounting .....      | 6.00  |

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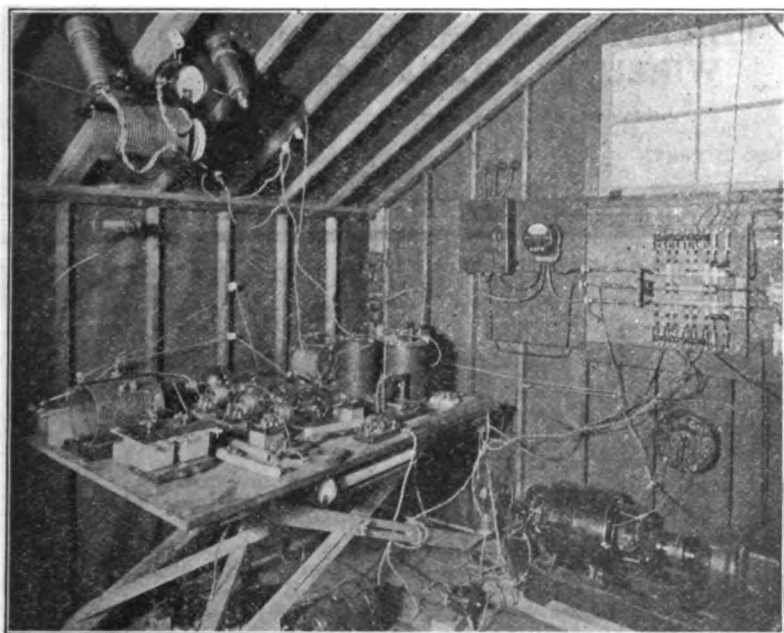
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## **RADIO PHONE PARTS**

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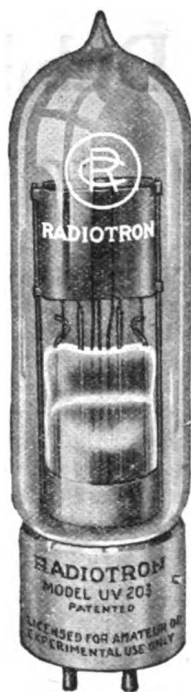
We have also a large stock of all reliable makes and ship same day order is received.

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Highly sensitive, light weight, exceptionally efficient. Will meet the most rigid requirements. Both receivers paired by test. Ability to bring in weak signals clearly makes them very popular with experimenters. Each Headset complete with 6 ft. moisture-proof cord.

**2200 Ohm**

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## **BUZZERS**

"HYTONE"  
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One to Six Stage Amplifying Receiving Sets  
SEND 10c. FOR CATALOGUE  
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MANSFIELD, OHIO

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*In the city of Bagdad lived Hakeem, the Wise One, and many people went to him for counsel, which he gave freely to all, asking nothing in return.*

*There came to him a young man, who had spent much but got little, and said: "Tell me, Wise One, what shall I do to receive the most for that which I spend?"*

*Hakeem answered: "A thing that is bought or sold has no value unless it contain that which cannot be bought or sold. Look for the Priceless Ingredient."*

*"But what is the Priceless Ingredient?" asked the young man.*

*Spoke then the Wise One: "My son, the Priceless Ingredient of every product in the market-place is the Honor and Integrity of him who makes it. Consider his name before you buy."*

THE  
ARE - DEE - CEE  
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is the Priceless Ingredient to look for on all Radio Equipment. Are-Dee-Cee on such apparatus stands for the very best in material obtainable, for skilled workmanship and unfailingly efficient performance.

This month's Are-Dee-Cee offering is a dependable Radiophone with a Range of 50 miles, for \$75.00 only. This price includes the Vacuum Tubes! Bulletin B, describing above sent on request.

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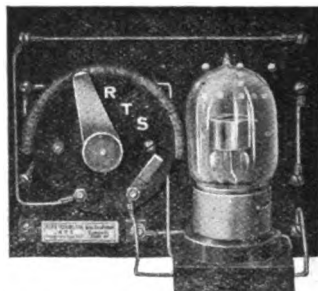
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- 5—Grid Condenser and Leak accurate
- 6—Sure Contact Socket
- 7—Socket Used as a Standard
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- 10—All Posts and Parts Perfectly Set

**\$5.95**

Without Tube Pre-  
paid by Insured  
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Parts for detector  
panel with cell holes  
drilled and everything  
ready to assemble,  
complete,

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Install this efficient R.T.S. Panel and you possess a correctly designed Detector Panel capable of producing signal strength unequalled by any other tested in our laboratory. It is guaranteed. Write for circular.

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## FULL LINE OF RADIO EQUIPMENT

of all leading manufacturers, Storage Batteries, Genuine double Filament Audiotrons \$5.00

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**The Superiority of Shell Type Transformers  
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## FOR FILAMENT HEATING

| Capacity<br>Watts | Sec.<br>Volts | Unmounted | Price<br>Mounted |
|-------------------|---------------|-----------|------------------|
| 80                | 8.5           | \$6.00    | \$7.00           |
| 150               | 12            | 8.00      | 10.00            |
| 300               | 12            | 12.50     | 15.00            |

## FOR PLATE SUPPLY

| Capacity<br>Watts | Secondary Each<br>Side of Neutral | Unmounted | Price<br>Mounted |
|-------------------|-----------------------------------|-----------|------------------|
| 100               | 350 and 550                       | \$11.00   | \$13.00          |
| 450               | 1000 " 1500                       | 16.00     | 18.00            |
| 900               | 1000 " 1500                       | 27.00     | 30.00            |

WE MANUFACTURE TRANSFORMERS DESIGNED FOR ONE  
5 WATT TUBE, WITH SECONDARY VOLTAGES OF 10 AND 650,  
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PROMPT DELIVERIES

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| B Batteries Eveready large-tapped 22½ V. | 3.00   |
| Tubes UV200 Radiotron Detector.....      | 5.00   |
| Tubes UV201 Radiotron Amplifier.....     | 6.50   |
| Tubes UV202 Radiotron Trans-5 watt..     | 8.00   |
| Tubes UV203 Radiotron Trans. 50 watt     | 30.00  |
| Tubes C300 Cunningham Detector.....      | 5.00   |
| Tubes C301 Cunningham Amplifier.....     | 6.50   |
| Tubes Electron Relay Detector.....       | 5.00   |
| Tubes A & P Amplifier.....               | 6.50   |
| Phones Murdock 2000-ohm.....             | 4.50   |
| Phones Murdock 3000-ohm.....             | 5.50   |
| Phones Brandes Superior.....             | 8.00   |
| Phones Brandes Navy.....                 | 14.00  |
| Phones Baldwin Type C.....               | 13.75  |
| Phones Baldwin Type E.....               | 15.00  |
| Phones Baldwin Type F.....               | 16.25  |

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| Sockets Murdock .....             | 1.00   |
| Sockets G.A. ....                 | 1.50   |
| Sockets DeForest .....            | 1.25   |
| Rheostats Paragon .....           | 1.50   |
| Rheostats DeForest .....          | 1.65   |
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| Corwin Dial & Knob 3½" .....      | 1.20   |
| Dial and Knob Chelsea.....        | 1.00   |
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| Transformers, Acme Mounted.....   | 7.00   |
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| Transformers, UV712 .....         | 7.00   |

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DeForest  
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Send 10c for Catalog.

### The "QSA" Line of Radio Equipment



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Our catalog of "QSA" equipment sent for 10 cents

Independent Radio Supply Co.

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"BETTER RESULTS WITH LESS EFFORT"

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You want your goods shipped promptly and post-paid. Save both time and money by ordering directly from this ad.

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| Q3-Radiotron #201, amplifier .....   | 6.50    |
| Q4-Radiotron #202, transmitter .....   | 8.00    |
| Q5-Murdock Moulded V-T Socket .....  | 1.00    |
| Q6-Crosley Porcelain V-T Socket .....  | .80     |
| Q7-Power Tube Rheostat, 5 ampere .....   | 1.85    |
| Q8-Firco Amplifying Transformer .....  | 5.00    |
| Q9-Murdock 43 plate Variable Condenser .....   | 4.50    |
| Q10-Amrad Variometer (honeycomb) .....   | 6.10    |
| Q11-Amrad Varicoupler (honeycomb) .....  | 6.90    |
| Q12-Anti-Capacity Switch .....   | 2.50    |
| Q13-Murdock 256 Phones .....   | 6.00    |
| Q14-Baldwin Amplifying Phones .....  | 13.75   |
| Q15-Large Burgess "B" Battery, 22½ volt..  | 2.25    |
| Q16-Burgess "Baby B" Battery, 4½ volt .....  | .40     |
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| Q18-Large Nickel Switch Points .....   | .04     |
| Q19-Large Nickel Binding Posts .....   | .11     |
| Q20-Cabinet 6"x14", Flemish Finish .....   | 3.30    |
| Q21-Formica Panel for same .....   | 2.10    |

Our new Radio Catalog describes Radio Telephones from 10 watts to 2 K. W. \$45 to \$4000; Spark Transmitters; Receiving Equipment; Antenna Materials; and the best line of Parts ever offered. It will be sent free with any order of \$1.00 or more from this advertisement; or mailed to any other address on receipt of 25 cents in stamps, which will be refunded on the first order for \$1.00.

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Norwood Nat. Bank Bldg., Norwood (Cincinnati) Ohio.



## Ask For These Folders

They tell all about Westinghouse Radio Receiving Sets, and about the Broadcasting Stations that provide a carefully balanced and judiciously chosen series of nightly entertainments, including news, weather, crop and stock reports, all kinds of sporting events and, on Sundays, complete church services.

Broadcasting stations are located as follows:

|                                      |            |
|--------------------------------------|------------|
| East Pittsburgh, Pa., Station "KDKA" | 360 meters |
| Newark, N. J., Station "WJZ"         | 360 meters |
| Springfield, Mass., Station "WBZ"    | 360 meters |
| Chicago, Ill., Station "KYW"         | 360 meters |

**Westinghouse Electric & Manufacturing Co.**

East Pittsburgh, Pa.

# Westinghouse

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

# SECOND ANNUAL AMATEUR RADIO Convention-Exhibition

A Real Radio Convention and a  
Real Exhibition of Radio Equipment

Pennsylvania Hotel—New York

MARCH 7-8-9-10-11, 1922

Another year has rolled around and the time for the Second District Convention and Radio Show, the big event of radio, is almost here. Everybody remembers, (for everybody was there), the smashing big success of last year. Well this year is going to add another big success to the history of radio. There isn't any doubt about it, for everybody who was there last year will be on hand again to meet everybody else, and will bring with them all the new converts to the cause created by radiophone broadcasting.

This Simon-pure radio show will be the most interesting and instructive affair of the kind ever held. The general arrangements are practically the same as last year.

The glass-enclosed roof garden of the hotel will be the exhibit hall, and the adjoining Butterfly Room affords an excellent lecture hall, with adequate seating capacity. Only papers of vital interest to amateurs will be presented.

Developments in the new and rapidly broadening field of radio have come thick and fast since last year. Some of them are so amazing in character and so far beyond anything yet generally known to the average radio operator, that any attempt to describe them on this printed page would result only in a very poor and inadequate effort. Come yourself and hear about them and see these new epoch-making devices in actual operation, and you will immediately wonder at the almost unlimited applications of radio to useful purposes.

A banquet for everybody, male and female, will be held on the night of the 11th (Saturday). And it's going to be SOME banquet.

*This convention-exhibition is held under the auspices of the Second District Executive Radio Council. It is non-partisan, non-sectarian, non-everything—just a straight out and out Second District Amateur Radio Affair, sponsored by all the radio clubs of the Second District. This is an unparalleled opportunity for material gain, for acquiring knowledge, the making of personal acquaintances, and for general good. It will be the biggest thing ever done in the history of amateur radio.*

## EXECUTIVE RADIO COUNCIL--Second District

### COMMITTEE

J. O. Smith, Chairman  
326 Broadway, New York

R. H. McMann, Ass't. Chairman

John Di Biasi  
A. F. Clough  
J. B. Ferguson  
C. Hobson

A. C. Mills  
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B. B. Jackson  
W. A. Remy  
W. J. Howell  
R. Hertzberg

L. M. Cockaday  
C. E. Huffman  
J. J. Kulick

This refers both to the dinner and what will be done and who will do it. All the big men of radio will be there.

That dusky-hued girl who was the sensation of last years' dinner will be there again, to demonstrate the last gasp in Hawaiian grass costumes. All male guests will be searched at the door for concealed lawn-mowers.

The Convention and Exhibition will open at 7 p.m., March 7, and will be open from 2 p. m. to 11 p. m. on the following days. A season badge will be sold at the door for 50 cents, covering the five days. One time admissions 25 cents.

The banquet charge will be \$4.00. The number which can be accommodated is limited to 600. Tickets will be allotted up to this number only, in the order in which applications are received. Applications by mail should be made to John Di Biasi, 6 Warren Street, New York.

Tickets are on sale at

Continental Radio & Electric Corporation,  
6 Warren Street, New York.

Manhattan Electrical Supply Company,  
17 Park Place, New York.

J. H. Bunnell Company,  
32 Park Place, New York.

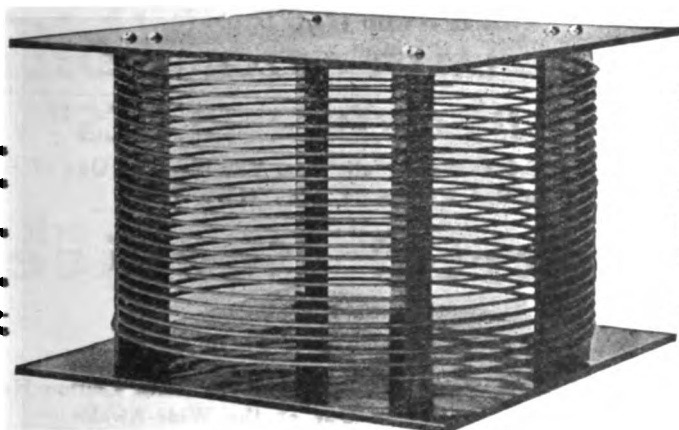
American Electro Technical Appliance Company  
235 Fulton Street, New York.

Wireless Press,  
326 Broadway, New York.



**C-W C-W C-W C-W C-W C-W C-W C-W**

CW Filters  
 CW Plate  
 Transformers  
 CW Condensers  
 CW Filament  
 Transformers  
 CW Iron  
 Core Chokes  
 CW Radio Fre-  
 quency Chokes



CW Power  
 Tubes  
 CW Rectifier  
 Tubes  
 CW Sockets  
 CW Rheostats  
 CW  
 Microphones  
 CW Tone Arms  
 CW Modulation  
 Transformers

**WIMCO CW 100 INDUCTANCE**

Get the **BEST CW Inductance**. Real connection clips provided, no uncertain switches which short circuit turns. Entirely insulated on Formica, high conductivity copper, very efficient. Made in 25 and 50 turn sizes, priced at \$10.00 and \$13.50 respectively. Also sold in parts ready to assemble.

We distribute the only complete line of panel type meters in America—Thermometers, AC and DC Voltmeters, Ammeters and Milliammeters. You can now equip your set with a complete set of meters all alike.

Big line of high voltage generators and motor-generators reasonably priced—just what you have been looking for.

## **SPECIAL NOTICE**

Grid coils for the above CW Inductance are now supplied so that the circuit described in July QST can be employed—and take it from us it is the **REAL** amateur circuit. Grid coil for the CW 100 Inductance priced at \$2.00. Ask for our new bulletin containing full dope on this circuit—try it on your own set, it's a winner.

## **Antenna Specials**

Now is the time to remodel your antenna and we are especially prepared to supply your needs in solid copper, stranded copper and copper-weld aerial wire.

### **Ask about the New Air Gap Type**

Antenna Insulators—wonderful for CW—priced right—positively superior to present forms and materials.

Send for special Antenna Material Bulletin or send 15c in stamps for catalog and complete literature.

**8ZV WIRELESS MANUFACTURING CO. 8ZV**

**CANTON, OHIO**

WIMCO apparatus is distributed in Canada by Ontario Radio Laboratory,  
 Sault Ste. Marie, Ont.

# Hullo Everybody!

(This is Radio KZC Speaking)

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Have You Ever Heard It? No! Well, Then You Must Be One of the Many  
Satisfied Customers Who Have Tried

## Wesrad Service

SEND FOR OUR  
LATEST PRICE DICTIONARY

It is indispensable to the Careful Purchaser. The Fifth Edition Has 3,000  
Circulation. Are You One of the Wide-Awake

Men Who Use This Bulletin and Service Exclusively?

## WESTERN RADIO ELECTRIC COMPANY

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We beg to announce our appointment as distributors for  
BALDWIN, BRANDES, MURDOCK, CLAPP-EASTHAM, CHELSEA,  
FIRTH, A B C, DEFOREST, MARSHALL-GERKEN and others  
SPECIAL THIS MONTH

Bakelite Cut any size— $\frac{1}{8}$ ,  $\frac{1}{4}$ , and  $\frac{1}{2}$ , 1  $\frac{1}{2}$  c, 2c and 2  $\frac{1}{2}$  c per square inch.  
Mail Orders Promptly Filled.

**Pittsburgh Radio and Appliance Co., Inc.**  
112 DIAMOND STREET, PITTSBURGH, PA.

"Pittsburgh's Radio Shop"  
Exclusive 8th District Distributors for  
"IDEAL" C W APPARATUS

## A n n o u n c e m e n t

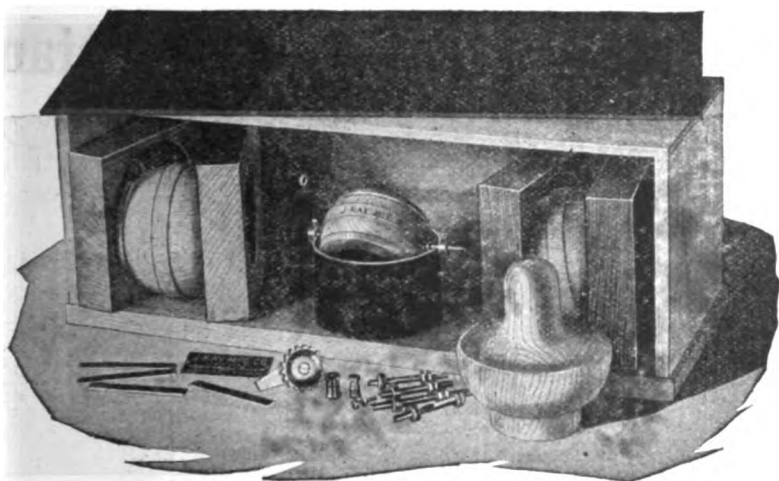
Our new catalogue #22 is just off the press.

Write for your copy today. The supply is limited so DO IT  
NOW!

## SERVICE RADIO EQUIPMENT

403 Madison Ave.,

Toledo, Ohio



### J-RAY UNASSEMBLED RECEIVER

**\$15.50**

**As Shown**

**200-600 meters**

**\$19.50**

**With All Windings**

**Save \$\$ on the cost of your receiving outfit by assembling your own.**

This complete set of parts, assembled in an hour's time, is a most exceptional value at only \$19.50 (\$15.50 if you do your own winding), and is our contribution towards the lower cost of Radio. Each set is of perfect workmanship, and sold under a money back if not satisfied, basis. Set consists of the following:

- 1 Stained Oak Cabinet, 18"x7"x7", removable top and back.
- 1 Polished Formica Panel, 18"x7"x1/8" to fit Cabinet.
- 2 Variometers, 4 3/4" square, mahogany wood, beautifully turned.

(Variometers are now being made "flush type" i.e., with edges grooved to accommodate bearing.)

- 1 Winding form for stator windings.
- 1 Formica Coupler primary tube 3 5/8"x2 1/2" high.
- 1 Coupler secondary ball, mahogany turned.
- 7 Contact Points, 6 Binding Posts, 1 Switch Lever, 2 Stops.

Set complete with all holes drilled, (except panel), all necessary brass parts, screws, etc., for assembling, with directions. Panel drilled \$0.50 extra. Dials \$1.00 each.

Undoubtedly one of the greatest values ever offered. Place your order today and be convinced. Remember, **money returned if not satisfied in every respect**

**Variometer Parts separate, wound \$3.90; unwound \$2.00 each.**

**Complete Vario Set comprising grid and plate Variometers and Variocoupler, all wound and ready to assemble, \$9.75. Cabinet only \$6.**

Unassembled receiver, as above, with detector and 1 step amplifier in slightly larger cabinet, \$29.50 Includes all windings.

We are distributors for all leading makes of apparatus, try us.

**J-RAY MFG. CO. 2131 DeKALB ST. ST. LOUIS, MO.**

# Tuska Moulded C. W. Inductances



Type 187—\$4.65



Type 186—\$4.15



Type 185—\$3.15

This latest Tuska development consists of a moulded inductance form four inches in diameter and six inches long. The threads for the wire are also moulded in, which insures not only a perfect mechanical process but the dielectric losses are less than in the case of a machined product.

The inductance is supplied in three forms as shown. The models are wound with No. 12 soft drawn copper wire. This will carry an average load of 50 watts. The inductances are tapped every third turn or every turn in which case they are staggered in three rows.

We are proud of this latest Tuska Product and invite you to inspect it at your dealers. The latest Tuska Catalog No. 2 is out and shows several new Products. Send 5 cents in stamps.

**THE C. D. TUSKA COMPANY, 10 Hoadley Place, Hartford, Conn.**

## RADIO FREQUENCY TRANSFORMERS

**Type RF-1 for amateur range \$6.00**

Mr. Amateur: Hook up a radio transformer ahead of your detector and get acquainted with stations you have not heard before.

The Type RF-1 is a:—

Transformer of special type R.F. iron core construction (Patent Pending.)

Transformer having complete shielding.

Transformer covering the amateur wave-length range efficiently.

Transformer giving maximum amplification per stage.

Transformer designed by former Government radio engineers.

Commercial and special range R.F. transformers supplied.



Incorporated

Asbury Park,

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## 4th DISTRICT! 5th DISTRICT! RADIO MEN!

**LOOK AT THESE PRICES, CAN YOU  
BEAT THEM?**

|   |        |
|---|--------|
| Switch contact points, Brass, Doz. ....   | \$ .25 |
| Switch contact points, N. P., Doz. ....   | .30    |
| Binding Posts, Brass, Each .....          | .07    |
| Binding Posts, N. P. Each .....           | .08    |
| Remler Switch Levers 1" .....             | .40    |
| Fada Rheostat .....                       | 1.00   |
| Wilcox Rheostat .....                     | .65    |
| Magnavox .....                            | 45.00  |
| Tuska Unassembled Reg. Tuner .....        | 27.50  |
| Formica Panels cut to order, Sq. In. .... | .02    |
| Our fully guaranteed "B" battery .....    |        |
| 22½ volt 15 cell plain .....              | 1.50   |
| 22½ volt 30 cell plain .....              | 2.50   |
| For variable add 25 cents .....           |        |
| 45 volt 60 cell plain .....               | 5.00   |

New Clapp-Eastham regenerative tuner complete with detector control .....

With each of these new HR sets we will give one B Battery free of charge.

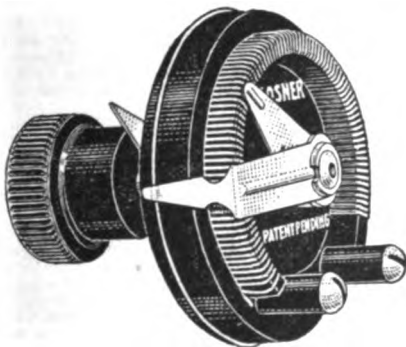
We carry a complete line of the famous JEWELL Thermo-Couple instruments.

Our complete stock enables us to ship your order same day received. Estimates furnished free on any CW or phone installation. We have a blue-print for you of a good CW hookup which you may have for the asking. We carry a full stock of the following goods: Clapp-Eastham, General Radio, Remler, Cunningham, Magnavox, DeForest, Federal, Formica, Chelsea, Murdock, Amarad, Firo, Tuska, RAC Grebe, Acme, Esco, Ace, Turney, Shramco, Patent Radio Corp'n, PADA, Branden, Baldwins, Willard "A" Batteries, American Radiograms and Postalgrams.

**SOUTHERN RADIO SUPPLY CO.**

Box 550, St. Petersburg, Fla.

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Patent Pending

## FOR THE MODERN CRITICAL TUBE

The first and only Vernier rheostat made having but

## One Single Knob

for both rough and fine adjustments

**SIMPLE**

**QUICK**

**POSITIVE**

Highly finished Condensite base and knob. Phosphor bronze contact springs.  
All metal parts polished nickel plate. Diameter  $2\frac{1}{8}$  inches.

**Price Only - - \$1.50**

Add shipping weight one pound.

Get it at your dealer or send direct to us.

Sold on a satisfaction or money back guarantee.

DEALERS—JOBBER—MANUFACTURERS: Write immediately for attractive proposition.

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**KLOSNER IMPROVED APPARATUS CO.**

2404 Crotona Avenue,

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# ATTENTION BUGS

Are you wise or do you just think you are? Are you going to profit by the other fellows experience or are you going to pay dearly for your own? Is it possible that there are still Amateurs who do not know what E. I. S. means? Don't stay in the rut and don't be so sure that Radio is an open book to you. E. I. S. has accomplished more for the amateur in the past year than any one factor and is daily making some Bug happier than ever.

Several months ago we sent our sales manager to the Pacific Coast to establish a chain of connections for the good of the game and as a result every first class dealer from Coast to Coast carries a complete line of our BLUEPRINTS. Ask yourself why—they know the game better than you, they know these BLUEPRINTS are the highest class work obtainable and are positively FOOLPROOF, they cover every conceivable branch of radio, they enumerate the most minute detail and why shouldn't they, they were only drafted after models had been perfected to the highest degree by final authorities.

What is it you want to build and cannot afford to buy as a finished product, what is it that you have built and wish to improve upon, let us solve your difficulty, we answer your questions gratis, we have one thing to offer and that is SERVICE. Send a self addressed envelope and receive one of our bulletins free covering 22 up to date receiving and transmitting devices, select the one you have your heart set upon and then let us make its assembly the simplest kind of task for you. Ask to see our BLUEPRINTS at your local dealers and you will be looking right into the heart of radio. GET BUSY, DON'T DELAY DO IT NOW.

## THE FOLLOWING DEALERS STOCK OUR BLUEPRINTS

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Atlantic Radio, Boston  
Continental Radio, N. Y.  
Manhattan, N. Y. & Chicago.  
Dreyfuss Sales Corp., N. Y.  
Detroit Elec., Detroit  
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Chicago Radio App., Chicago  
Telephone Maintenance, Chicago

Comm. Edison Co., Chicago  
Wolfe Elec. Omaha  
Western Radio, Kansas City  
Martin Elec., Wayneville, N. C.  
Precision Equip., Cincinnati  
Scientific Exp., Montreal  
Salton Radio, Winnipeg  
Marconi Co., Vancouver  
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Stubbs Elec., Portland  
Northwestern Radio, Portland  
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Leo J. Meyberg, Los Angeles  
Cope & Cornwell, Salt Lake  
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## Experimenters Information Service

45 PINEHURST AVENUE,

NEW YORK CITY

## The Transatlantics---

have made good the faith in C.W. We can supply you with any C.W. apparatus that you may need in putting in that new set, Esco and Ray-Di-Co motor-generators, Radio Corporation, Acme, Thordarson, Jewell C.W. apparatus, etc. Also in complete fone and C.W. sets, the Paragon and Jun-O-Fon cannot be beaten, and the Benwood "assemble your own" is a real DX C.W. and fone set.

We have the best line of C.W. and spark receivers made: THE BIG 3: Z-Nith, Paragon RA-10 and the Radio Shop RS 1-24 regenerators, also Telmaco, Chi-Rad, Mageco parts and receivers. For extremely loud signals, the new Magnavox power amplifier used with the Radio Magnavox or Telemegaphone sure is "the berries."

In building a regenerator or tube equipment we recommend Chi-Rad, Telmaco, Mageco or Remler variometers and couplers, Paragon matched dials, Paragon or Fada rheostats, Thordarson or All-American amplifying transformers, Paragon, etc., sockets, Federal jacks and plugs, etc. Baldwin Type E fones now only \$13.00. A fresh supply of Burgess B batteries always in stock.

You can get anything advertised in this magazine from us, as we can supply you with "Everything worth while in Radio"

**Tri-State Radio Mfg. & Supply Co.**

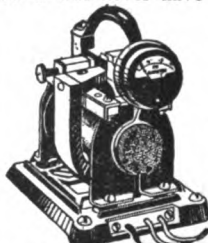
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## 10c. Charges Your Storage Battery AT HOME WITH AN F-F Booster

So U will never have to give up, in disgust when



working a distant station. Is it not gratifying to feel that your filament battery will always be ready when you want it? You Know What its like to have friends call to "listen in" & then find your battery dead.

F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up.

The AMMETER shows you just the amount of current flowing. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes which maintain a constant efficiency and last for thousands of hours. Everything Complete in One Compact, Self-Contained, Portable Charging Unit. F-F Boosters are Magnetic Rectifiers for 105-125 Volt 60 Cycle Alternating Current. PRE-WAR PRICES: Bantam Type 6 charges 6 Volt Battery at 6 Amperes \$15 Bantam Type 12 charges 12 volt Battery at 5 Amperes \$15 Type 166 Charges 6 Volt Battery at 12 Amperes \$24 Type 1612 Charges 12 Volt Battery at 7 Amperes \$24 Type 1626 Charges Both 6 and 12 Volt Batteries \$36 Shipping Weights 12 to 15 Pounds

Order from your Dealer or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use our Full Wave Automatic F-F Rotary Rectifier of 100 Volt, 36 cell capacity. Order Now or Write for Free BOOSTER Bulletin No. 31 or ROTARY 31A

**The France Mfg. Co. CLEVELAND, OHIO, U.S.A.**

Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

# MURDOCK

## *radio necessities*

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No. 56

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the riveting of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. **Prices \$4.50 to \$6.00.**

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and variometers, and the new Murdock Rheostat at \$1.00. Send for Free catalogue.

## WILLIAM J. MURDOCK Co.

**65 CARTER ST.,  
CHELSEA, MASS.**

*Pacific Coast Office, 509 Mission Street, San Francisco, Cal.*

*New York Sales Office,*

*1270 Broadway, New York.*



## Insist on the SOMERVILLE DIAL INDICATOR

To determine the percentage of sales we make through QST ads, we make the following combination offers. These offers good to QST readers only.

- 1 DeForest 6 Ohm Filament Rheostat Reversible ..... \$1.65
- 1 DeForest Moulded Condensite VT Socket ..... 1.25
- 6 15c Insulated Top Binding Posts ..... .90
- 1 UV200 Radiotron ..... 5.00
- 1 #766 Eveready large B Battery ..... 3.00

**\$11.80**

**COMBINATION PRICE**  
**\$10.00 POSTPAID**

- 2 22½V SORSINC "B" Batteries @ \$4.00 ..... \$8.00
- 1 AP Amplifier Tube 6.50

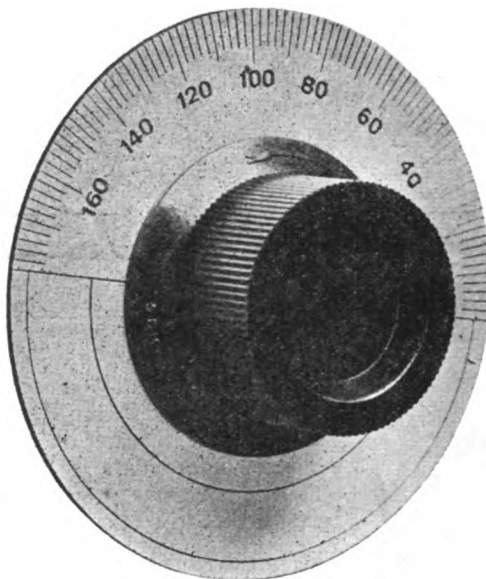
**\$14.50**

**COMBINATION PRICE**  
**\$14.00 POSTPAID**

- Complete parts of Wimo 25 Turn CW Inductance ..... \$5.50
- UV202 Radiotron ..... 8.00

**\$16.50**

**COMBINATION PRICE**  
**\$15.50**



**SOMERVILLE RADIO LABORATORY**  
**176-178 Washington St., Dept. QST**  
**Boston, Mass.**

Send 25c for our ENLARGED Catalog!

At  
the

**NEW  
PRICE**

**\$1.75**

for the 4" Dia. model and

**\$1.60**

for the new 3¼" dia. model

**POSTPAID**

from us, or from your dealer

New lot has dial insulated from shaft, so that dial may be grounded to act as a shield.

**Why Pay More?**

**SOMERVILLE**  
**1000V CW**  
**Condensers**

**75c Postpaid** Post Paid

## Using An Inefficient Radio Set Is A Disappointment

We won't disappoint you because we handle the things that are really worth while in Radio. Our stock includes receiving and transmitting apparatus desirable for Spark, C.W. and Phone made by:

- |              |               |
|--------------|---------------|
| Grebe        | Pacent        |
| Westinghouse | Cunningham    |
| Acme         | Tuska         |
| Burgess      | Federal       |
| Magnavox     | Clapp-Eastham |
| Remler       | Baldwin       |
| Chelsea      | Jewell        |
| Murdock      |               |

Pioneer makers of Andrae Telephones. In business 60 years.

Our service is of the best and the quality of our goods unquestionable. Identified with telephone and electrical development of the Northwest since its beginning.

**Julius Andrae & Sons Co.**  
**119 Michigan Street,**  
**MILWAUKEE**

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## RADIO CITIZENS

Complete stocks carried for immediate shipment of the following apparatus:

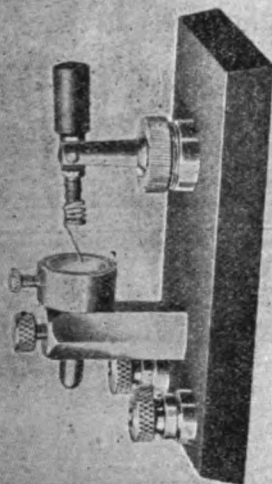
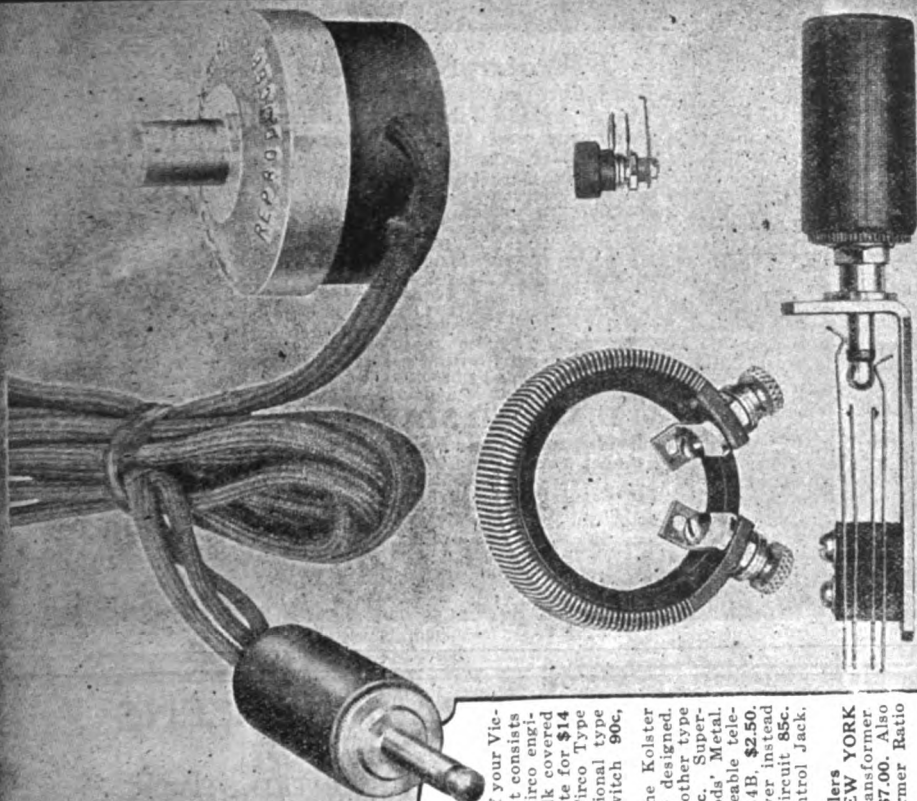
- |                                   |                   |
|-----------------------------------|-------------------|
| Grebe                             | Murdock           |
| DeForest                          | Adams-Morgan      |
| Acme                              | Radio Corporation |
| C. Brandes, Inc.                  |                   |
| Federal Telephone & Telegraph Co. |                   |

**FREE BULLETIN**  
**PRICE LISTS**

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

**Nash Electrical Service Co.**

**Marshall, Ill.**



## Make Your Own Loud Talker!

NEW Vocaloud phonograph attachment fits tone-arm of your Victor or Columbia phonograph or metal horn. This outfit consists of a Vocaloud reproducer, altered in accordance with Firco engineering design, with special moulded cap, six feet of silk covered cord and Firco round type "Bull-Dog-Grip" Plug, complete for \$14.00. Mount the Firco resistor and the Firco Type I FIRCO Rheostat. Mount the Firco resistor and the Firco Type I 7-A switch on your panel and you have a professional type Rheostat, 100% air cooled and closely variable. Switch 90c, Resistor 50c. Both together \$1.30.

HERE is the Crystal Detector exactly as used on the Kolster Decimeter. The most easily adjusted detector ever designed. Satisfaction guaranteed in direct comparison with any other type of Crystal Detector. Price \$2.50. Silicon Crystal 25c. Super-sensitive Galena Crystal, 40c. Both mounted in Woods' Metal. I FIRCO Jacks and Plugs. "Bull-Dog-Grip" interchangeable telephone plugs. Flat type, 34A, \$2.00, round type 34B, \$2.50. Firco Jacks, 99% sterling silver contacts. Nickel silver instead of phosphor bronze springs. Open circuit 70c. Closed circuit 85c. Double circuit \$1.00. 3 spring automatic filament control Jack. \$1.15. 5 spring automatic filament control Jack, \$1.40.

Examine Firco products at all leading radio dealers JOHN FIRTH & CO., INC., 18 BROADWAY, NEW YORK. Ask your dealer to show you the new Firco-Clad transformer. Slightly larger than the Saco-Clad. Ratio 1:9. Price \$7.00. Also the new improved Saco-Clad audio frequency transformer Ratio 1:8. Price \$6.00.

# For Radio Panels

## Waterproof Fibre Insulation

Hard fibre is the toughest dielectric known. Add to Diamond Hard Fibre the commanding quality of water-resistance and the combination produces Condensite Celoron—the last word in electrical insulation.

This remarkable material marks a new era in the wireless world. In addition to being waterproof, high in dielectric strength and light in weight, Condensite Celoron is insoluble, infusible and immune to the effects of climatic or atmospheric change. Read this Bureau of Standards test:

| Wave Length | Approximate Frequency | Phase Difference | Dielectric Constant-K |
|-------------|-----------------------|------------------|-----------------------|
| Meters      | Cycles per second     | Degrees          |                       |
| 373         | 804,000               | 2.0              | 4.7                   |
| 1,295       | 231,500               | 1.8              | 4.8                   |
| 3,067       | 97,800                | 1.8              | 4.9                   |

We supply Condensite Celoron in standard size sheets, rods and tubes ready for all machining purposes—for experts and amateurs. Sold by radio equipment dealers everywhere. If your dealer cannot supply you, write us.

### DIAMOND STATE FIBRE COMPANY

Bridgeport (near Philadelphia) Pa.

Branch Factory and Warehouse, Chicago

Offices in principal cities.

In Canada: Diamond State Fibre Co. of Canada, Ltd. Toronto



## DEALERS AND RADIO CITIZENS

Order Your Needs From Our

**LARGE AND COMPLETE ASSORTED STOCK**

**PARTS OF ALL KINDS**

**COMPLETE SETS**

**LARGEST STOCK RADIOTRONS AND KENOTRONS IN U. S. A.**

**ALL TUBES SHIPPED PREPAID**

Write for our new price list No. 100-T



**LUDWIG HOMMEL & CO.**

**530-534 Fernando St.,**

**PITTSBURGH, PA.**

## QST AMATEURS-EXPERIMENTERS QST

**Our Stock of C.W.**

**TRANSMITTING  
AND RECEIVING**

**Apparatus Now Complete**

**FADA POWER RHEOSTATS....\$1.35**

**G. R. HOTWIRE METERS..... 7.75**

**UV202 5W. POWER TUBES.... 8.00**

**TUSKA INDUCTANCE (new type) 4.65**

**TYPE C BALDWIN PHONES..\$12.00**

**TYPE E BALDWIN PHONES.. 13.00**

**REMLER VARIOMETERS (less**

**dial) ..... 6.00**

**AMRAD VARIOMETERS (with**

**dial) ..... 6.75**

**\$1.00 Per Coil  
200 Feet**

**AEROPLANE ANTENNA WIRE**

**Per Coil \$1.00  
200 Feet**

(Composed 16 Strands No. 30 Bare Copper)

(Include Postage on Two Pounds) ...

**"THE HOUSE OF SERVICE"**

**LINZE ELECTRICAL SUPPLY CO.**

**1129 OLIVE ST.**

**DEPT. Q2**

**ST. LOUIS, MO**



The Detector—SP-1



The Two-Step Amplifier—SP-2

## A NEW DeFOREST LINE of RECEIVING INSTRUMENTS The SP Series

Appearance and efficiency have been combined in these instruments to make equipment of which any amateur may be proud. Binding posts are mounted on bakelite insert strips set in the rear of cabinets. Jacks are of the filament control type, disconnecting filaments and amplifying transformers not in use and making unnecessary, frequent re-adjustments of rheostats. Panels are of engraved  $\frac{3}{8}$ " bakelite, all visible parts are heavily nickeled, hinged tops permit ready access to interiors for insertion of tubes and for inspection. Deluxe equipment at moderate prices.

SP-1.....\$18.50

SP-3.....\$42.00

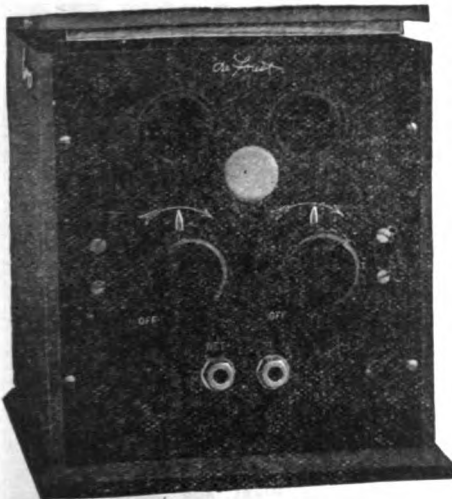
SP-2.....\$48.00

SP-4.....\$65.00

ALL PRICES F.O.B. NEW YORK

**DeForest Radio Telephone and Telegraph Company**  
1391 Sedgwick Avenue, New York City

Western Distributors: Atlantic Pacific Radio Supplies Company,  
638 Mission Street, San Francisco, Cal. Henry M. Shaw, Pres.



The Detector and 1-Step—SP-3



The Detector and 2-Step—SP-4

# COMBINATION OFFERS

## —for RADIO CITIZENS

Parado Combination Offer No. 1 for a complete receiving set.

|  |         |
|--|---------|
| 2 Remler Variometers with dial.....                          | \$14.00 |
| 1 Remler Variocoupler, with dial.....                        | 6.40    |
| 1 Switch and 10 Contact Points (nickel-plated)               | 1.00    |
| 2 Stops and 3 Indicators, (nickel-plate)....                 | .25     |
| 1 Murdock No. 56 Headset.....                                | 5.00    |
| 1 Burgess Battery, 22½ volts.....                            | 2.25    |
| 1 Radiotron or Moorhead Tube.....                            | 5.00    |
| 1 Murdock Rheostat.....                                      | 1.00    |
| 1 DeForest Socket.....                                       | 1.00    |
| 1 Panel 6x22x½.....  | 1.95    |
| 7 Nickel Plated Binding Posts.....                           | .70     |
| 12 Feet connecting wire.....                                 | .10     |
| 1 Diagram of panel drillings and hook-up of instruments..... | FREE    |

Total.....\$38.68  
OUR SPECIAL COMBINATION PRICE,.....\$34.80

Get our other Combination offers. Write for Free Price List and Bulletins on Parado Offers.

## —for DEALERS and AGENTS

Get our Special Combination Offers to Dealers and Agents on apparatus made by these well known companies:

JEWELL, MOORHEAD, DEFOREST, BALDWIN, GREBE, BRANDES, MURDOCK, PACENT, ACME, FEDERAL, RADIO CORPORATION.

We represent the largest manufacturers of the best equipment made. If you are an agent or dealer get our special discount lists and bulletins.

## Peoria Radio Sales Co.

Dept. A.

PEORIA

Illinois

## KLAUS

RADIO CO.

Dept 100.

EUREKA, ILL.

**FIRST TESTED THEN SOLD**

## Prepared Radio Measurements

with  
Self Computing Charts  
by Ralph R. Batcher

A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

**PRICE \$2.00**

## The WIRELESS AGE

*The magazine that meets  
all your expectations.*

When its new you find it in the AGE. Every step in radio progress is fully and carefully described. You miss a lot of good things unless you read the AGE. \$2.50 per year, Postage outside U. S. 50c.

**SPECIAL OFFER ONLY**

Prepared  
Radio  
Measurements

&

The  
Wireless  
Age  
1 Year

**\$4.00**

Outside U. S.  
50c. Extra

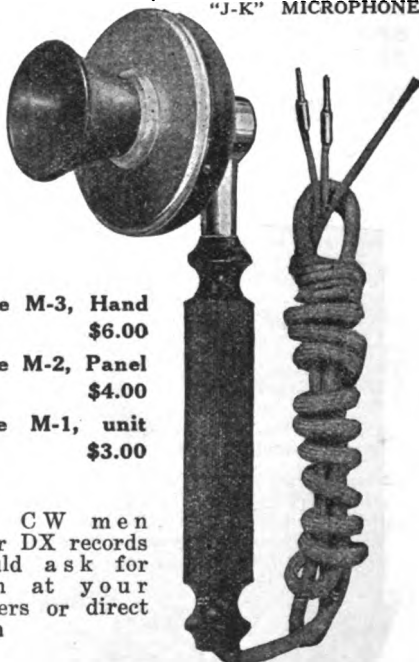
This offer expires Dec. 15, 1921.

**WIRELESS PRESS INC.**

**328 Broadway, New York**

The Hit of the ARRL Radio Show at Chicago Was the

"J-K" MICROPHONE



Type M-3, Hand  
\$6.00

Type M-2, Panel  
\$4.00

Type M-1, unit  
only \$3.00

You CW men  
after DX records  
should ask for  
them at your  
dealers or direct  
from

Type M-3

Priced Right and Made Right

JOY and KELSEY

4021 W. KINZIE ST.,

CHICAGO, ILL.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# Highest Grade Radio Apparatus



"The Very Best in Radio"

## Order Direct From This Ad. SAVE TIME -- SAVE MONEY

### AMPLIFIERS

|   |        |
|---|--------|
| Remler 331 Panel .....                              | \$5.00 |
| Remler 333 Panel .....                              | 9.00   |
| Telmaco TDA-1 Detector and 1 step Amplifier .....   | 35.00  |
| Telmaco TA-2 Two-step Amplifier .....               | 40.00  |
| Telmaco TDA-2 Detector and two-step Amplifier ..... | 45.00  |

### AMPLIFYING TRANSFORMERS

|  |        |
|--|--------|
| New Thordarson fully mounted .....     | \$4.00 |
| All-American R-3, 10-1 Unmounted ..... | 3.50   |
| All-American R-3, Semi-mounted .....   | 4.00   |
| All-American R-3, Mounted .....        | 4.50   |

### AUDION CONTROL PANELS

|  |        |
|--|--------|
| Remler 330 Panel .....                   | \$5.00 |
| Telmaco TD-1 Detector with Cabinet ..... | 15.00  |

### ANTENNA WIRE

|   |        |
|---|--------|
| #14 Gauge Copper Wire 12' .....         | \$0.45 |
| #14 Gauge Copper Wire 25' .....         | 0.85   |
| #14 Gauge Copper Wire 50' .....         | 2.00   |
| 7-Strands #22 Copper Wire, 100 ft. .... | 1.00   |
| 7-Strands #22 Copper Wire, 200 ft. .... | 1.80   |

### "B" BATTERIES

|                                       |        |
|---------------------------------------|--------|
| Stuart 5677, 22½ Volt .....           | \$2.25 |
| Stuart 5674, Navy Type 22½ Volt ..... | 3.00   |
| Stuart 5680, 45 Volt .....            | 5.00   |
| Stuart 5685, 4½ Volt .....            | .60    |

### CONDENSERS

|  |        |
|--|--------|
| Remler 97 Grid Condenser .....                               | \$0.35 |
| Bowman, Murdock and Chelsea Condensers at advertised prices. |        |

### DIALS

|   |        |
|---|--------|
| Remler Bakelite with Knob ¼ or ½ inch ..... | \$1.00 |
| Bowman 121 Metal Dial .....                 | .60    |
| Clapp-Eastham 3 inch Metal Dial .....       | .75    |
| Chelsea Molded ¼ or ½ inch .....            | 1.00   |

### GROUND EQUIPMENT

|  |        |
|--|--------|
| Westinghouse 100 Ampere 600 Volt Ground Switch ..... | \$4.00 |
| Ground Clamp .....                                   | .10    |

### JACKS

|                                     |        |
|-------------------------------------|--------|
| Single Circuit for Phones .....     | \$0.85 |
| Two Spring Closed Circuit .....     | 0.75   |
| Four Spring Open Circuit .....      | 0.90   |
| Three Spring Filament Control ..... | 1.00   |
| Five Spring Filament Control .....  | 1.25   |

### LOUD SPEAKERS

|                             |         |
|-----------------------------|---------|
| R-3 Radio Magnavox .....    | \$45.00 |
| Vocaloud Station Type ..... | 30.00   |

These are only a few of the many good Radio Supplies listed in our catalog "T". If you haven't a copy, send for it.

Send your order today. Be sure to include postage. Money back if not satisfied.

Your panels engraved with our GORTON ENGRAVER. Price 5 cents per letter. Minimum charge \$2.00

DEALERS! We are distributors for nearly all Standard Lines. Write for our special proposition.

Telmacophone equipped with Baldwin unit, Guaranteed to equal anything at double the price .....

15.00

### JEWELL FLUSH TYPE METERS

|  |        |
|--|--------|
| Pattern 33 D.C. Standard Readings .....            | \$6.00 |
| Pattern 54 D.C. Standard Readings .....            | 8.00   |
| Pattern 64 Radio Frequency Standard Readings ..... | 12.00  |
| Pattern 74 A.C. Standard Readings .....            | 8.00   |

### PLUGS

|                             |        |
|-----------------------------|--------|
| Standard Plug T-180 .....   | \$1.00 |
| Short Radio Plug #132 ..... | 1.00   |
| Fire Round Plug .....       | 2.50   |

### RHEOSTATS

|  |        |
|--|--------|
| Murdock 560 Reversible .....             | \$1.00 |
| Remler 810 Panel Mounting .....          | 1.00   |
| Remler 813 Panel Mounting .....          | 1.75   |
| Remler Potentiometer Graphite Unit ..... | .75    |
| Lever for Above .....                    | .45    |
| Paragon Reversible .....                 | 1.50   |

### SOCKETS

|                                      |        |
|--------------------------------------|--------|
| Crosley Porcelain Socket .....       | \$0.60 |
| Murdock 550 Socket .....             | 1.00   |
| Chelsea Socket .....                 | 1.00   |
| Remler Bakelite Socket .....         | 1.50   |
| A.A. 50 Watt Power Tube Socket ..... | 3.00   |

### TELEPHONES

|  |        |
|--|--------|
| 56 Murdock Double 2000 Ohm Receivers ..... | \$8.00 |
| 56 Murdock Double 3000 Ohm Receivers ..... | 6.00   |
| Brandes Superior Double Receivers .....    | 8.00   |
| Baldwin Type C Double Receivers .....      | 12.00  |
| Baldwin Type E Double Receivers .....      | 13.00  |
| Baldwin Type F Double Receivers .....      | 14.00  |

### TRANSMITTERS

|  |        |
|--|--------|
| Type T281 Microphone with Handle ..... | \$6.00 |
| Microphone and Mouthpiece only .....   | 2.50   |

### VACUUM TUBES

|   |        |
|---|--------|
| C 300 Cunningham Detector Tubes .....           | \$5.00 |
| C 301 Cunningham Amplifier Tubes .....          | 6.50   |
| C 302 Cunningham 5 Watt Transmitting Tube ..... | 8.00   |
| ER Moorhead Detector Tubes .....                | 5.00   |
| VT Moorhead Amplifier Tubes .....               | 6.50   |

### VARIOMETERS

|                                      |      |
|--------------------------------------|------|
| Telmaco Type TV-1 without dial ..... | 5.00 |
| Remler Type 500 with dial .....      | 6.00 |

### VARIOCOUPERS

|                                       |        |
|---------------------------------------|--------|
| Telmaco Type TVC-1 without dial ..... | \$4.00 |
| Remler Type 503 without dial .....    | 5.40   |

## RADIO DIVISION

# Telephone Maintenance Co.

17 N. LaSalle St.,

Chicago, Ill.



# This letter was Unsolicited



## Kico "B" Battery

Kico Storage "B" Batteries will end your troubles. Years of Real Service, Saves you money in the end. One charge lasts 3 to 6 months. Short circuiting, overcharging, standing idle **DOES THEM NO HARM.** Beautifully constructed, Hand finished. Following prices include Rectifiers, chemicals and directions. One quart of distilled water and your battery is in service.

Plain With Panels

|   |        |         |
|---|--------|---------|
| 24 Cells.   |        |         |
| 32V.  | \$8.00 | \$10.00 |
| 36 Cells  |        |         |
| 48V.  | 10.00  | 12.00   |
| 50 Cells  |        |         |
| 68V.  | 12.00  | 15.00   |
| Money refunded if unsatisfied after three months trial. |        |         |

Charlottesville Radio Club  
Room 405 National Bank Bldg.  
Charlottesville, Va.

Kimley Electric Company,  
Gentlemen:

It is with great pleasure that I am writing this letter to express to you the satisfaction I have obtained with the Storage 'B' Battery that I purchased from you some time ago.

Your claims for it are far from being good enough to cover all the good points that I have found for it since it has been installed at this station.

I will be glad to recommend it to the radio Fraternity as I desire to have all Radio men know just how and where a real Storage "B" Battery can be purchased.

Very truly yours:

(Signed) Fred T. Bradley  
Radio 3BHL. Sect'y.



## Kico "A" Batteries

(Acid Proof)

No more acid eaten rugs, furniture, etc. Truly a parlor battery designed especially for wireless den. Built sturdy enough to kick over Ford, Chevrolet or any car taking battery 9"x7"x7". Box and jars moulded in one piece from acid proof composition many times tougher than hard rubber. 6 volt 80 to 100 A. Hrs. \$24.00 Guaranteed 18 mos. Same battery in neat wooden box \$21.00 F. O. B. Buffalo.

## KIMLEY ELECTRIC CO.

290 WINSLOW AVE., BUFFALO, N. Y.  
Further information gladly furnished on request.

## HOMCHARGE YOUR BATTERY for A Nickle

### THE HOMCHARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is selfpolarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replaceable as a unit for \$1.00.

The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than \$100. Bulletin 628 proves it. Ask for your copy. Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price \$18.50.

THE AUTOMATIC ELECTRICAL DEVICES CO.  
127 West Third St., Cincinnati, Ohio

Canadian Distributors  
ROWLEY & MOODY  
Ltd., Toronto



## Will you help us to help you?

**T**HE demand for radio supplies has taken an enormous spurt recently. It has strained our every resource to maintain our reputation for on-time-delivery.

You can help us—by placing your orders for radio equipment as far in advance as possible.

May we not count on you for this co-operation, which will help us to give you the same prompt service to which you have been accustomed.

## MANHATTAN Electrical Supply Co., Inc.

A NATIONAL INSTITUTION

New York City: 17 Park Place,  
110 W. 42nd St., 127 W. 125th St.  
St. Louis: 1106 Pine St.  
Chicago: 114 S. Wells St.



# FORMICA

Made from Anhydrous Redmanol Resins  
**SHEETS TUBES RODS**

## Good Looks and Perfect Insulation

**F**ORMICA panels for radio equipment have a splendid gloss or satin finish. They machine perfectly, and encourage neat workmanship. They give you a panel you will always be proud to show your friends! Weather will never affect its looks!

Most radio troubles are due to failure of insulation, to power loss and losses due to hysteresis. Formica has a dielectrical strength of 700 to 1300 volts per 1/1000 of an inch and an angle of phase difference so small that hysteresis losses with currents of high frequency are negligible.

The country's greatest engineers approve your judgment when you use Formica!



**DEALERS:** We co-operate with you. You can buy Formica in the **sized** sheets for which you have the greatest call—or in full sized 42 x 36 sheets which you can cut yourself. Write for our dealer helps!

**THE FORMICA INSULATION COMPANY**  
**CINCINNATI, OHIO**



# RHAMSTINE<sup>\*</sup>

## Introduces The

# ADAPT-O-PHONE

In the most convincing manner the Rhamstine<sup>\*</sup> Adapt-O-Phone fulfills the demand for a satisfactory loud-speaker at a reasonable price. Reference to the cut will show a standard headset held in position against the special manifold by knurled screws—your own receivers are used—readily inserted or removed. One can quickly understand that the sounds from two receivers of matched tone, are more audible than if but one receiver is used. Herein is a valuable feature of the Adapt-O-Phone. Sounds from the two receivers enter the small end of the horn, are rounded out and amplified in clear un-distorted tones.

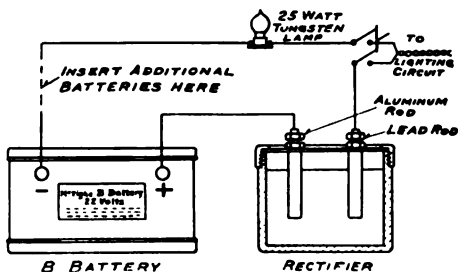
In addition to its being a most satisfactory loud-speaker, the Adapt-O-Phone is a very attractive unit. The horn is metal, black japanned; the manifold casting heavily plated and polished and is equipped with rubber sleeves to protect the receivers. The base is of wood finished in hand-rubbed mahogany. It stands 20" high.

**Price** Without Receivers **\$12**

Add 25c. for Postage and Packing  
West of Rocky Mts. 40c.

**J. THOS. RHAMSTINE<sup>\*</sup>** 2152 E. LARNED ST.,  
Detroit, Mich.

### The McTighe Storage B Battery



### The McTighe Storage B Battery

is of alkaline type and is practically indestructible. Its capacity is ample for a several stage amplifier and a one hour charge will last for several weeks in ordinary service. No injury is caused by accidental short circuit or by standing idle.

The Battery is contained in an attractive black metal case 6 inches diameter, 8 inches high. Cells are held rigidly in place, and tight metal cover prevents evaporation.

As many as four units in series can be charged from one rectifier on 110 volt A.C. lighting circuit.

Write for descriptive leaflet, or better, order a Battery and rectifier today.

Dealers—The McTighe B Battery has no shelf depreciation.

Battery .....\$3.50  
Rectifier ..... 1.25

Postage and packing 20c extra

**McTIGHE BATTERY COMPANY**

WILKINSBURG, PA.

### FOR IMMEDIATE DELIVERY

Look Over This List. Does It Suggest Anything You Need?

|  |        |
|--|--------|
| Firco Sockets  | \$1.10 |
| Victor Sockets Fused   | 1.00   |
| Simplex Variometer   | 6.00   |
| Remler Variometer  | 6.50   |
| Amrad Variometer   | 6.75   |
| Plugs Bulldog  | 2.50   |
| Plugs Federal  | 1.75   |
| Jacks Open Circuit   | .70    |
| Jacks Closed Circuit   | .85    |
| Jacks Two Circuits   | 1.00   |
| "B" Batteries—Firco Large  | 3.00   |
| "B" Batteries Eveready Large   | 3.00   |
| "B" Batteries Firco Small  | 2.25   |
| "B" Batteries Standard Small   | 1.50   |
| 6 Volt 35 Amp. Storage Battery   | 6.00   |
| 6 Volt 60 Amp. Storage Battery   | 12.00  |
| Saco Clad Transformers   | 5.00   |
| Thordarson Transformers  | 4.00   |
| Firco Rheostats  | 1.30   |
| Paragon Rheostats  | 1.50   |
| General Radio Rheostats  | 2.50   |
| UV200 Tubes  | 5.00   |
| UV201 Tubes  | 6.50   |
| Murdock Condenser .001   | 4.00   |
| Murdock Condenser .0005  | 3.25   |
| Murdock Phones—3000 Ohm  | 6.00   |
| Seibt Phones   | 7.75   |
| Brown Phones   | 16.00  |
| Contacts Nickel Plated   | .03    |
| Contacts Nickel Plated Large   | .05    |
| Aerial Wire #14 Pure Copper per 100 ft.  | .60    |
| Aerial Wire Stranded Copper per 100 ft.  | .50    |
| Aerial Insulators 2 1/4" Type  | .25    |
| Aerial Insulators 4" Type  | .40    |
| WESTINGHOUSE, GREBE, AMRAD, FIRCO, MAGNAVOX EQUIPMENT AT REGULAR PRICES. SMALL PARTS, SUCH AS WIRE, SWITCHES, PANELS, DIALS, PHONE CORDS, ETC., ALWAYS IN STOCK. |        |

**CLARION RADIO SHOP**

347 MAIN ST., POUGHKEEPSIE, N. Y.

# Duplicate the Set Heard Across the Atlantic

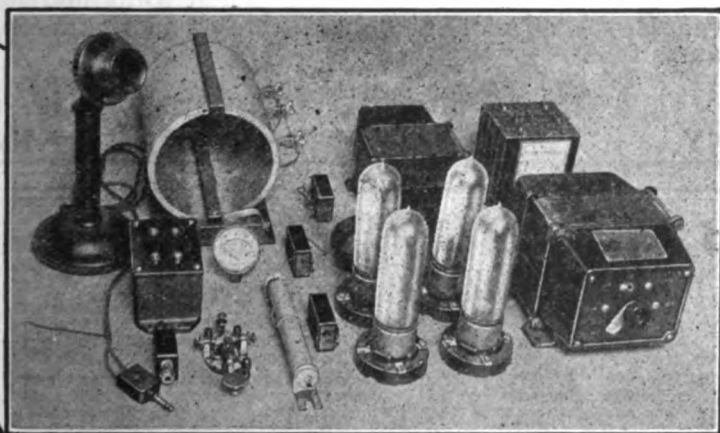
Amateur history was made on December 9, when 1BCG in Greenwich, Conn., was heard in Ardrossan, Scotland—a distance of over 3500 miles.

This amazing feat was performed with four Radiotrons UV-204—one used as a master oscillator, the other three as amplifiers.

There was nothing special about 1BCG's equipment. His circuit was similar to those described and illustrated in the RCA Catalogue for CW transmission.

You can duplicate the equipment used at 1BCG for experimental communications at a comparatively small expense.

Look over the RCA Catalogue and Instruction Book. Select the set most suitable for your needs, and then order the required parts from your nearest dealer.



100 Watt Radio Telephone Transmitter

Microphone and Stand .....\$15.00  
Jack (\$1), Plug (\$2), Cord (\$1.50) ..... 4.50  
Oscillation Transformer UL-1006 ..... 11.00  
Magnetic Modulator UT-1367 17.00  
Antenna Ammeter UM-533 6.25  
Sending Key UQ-909 ..... 3.00

Transmitter Grid Leak UP-1718 .....\$ 1.65  
Transmitter Condensers UC-1015 ..... 5.40  
Transmitter Condensers (2) UC-1014 ..... 4.00  
Filter Reactor UP-1627 ..... 15.75  
Radiotron Power Tubes UV-203 (2) ..... 60.00

Radio Frequency Choke ... 2.00  
Kenotron Rectifier Tubes UV-217 (2) .....\$53.00  
Filter Condensers (5) UC-1635 ..... 10.00  
Power Transformer UP-1016 38.50  
Incidentals ..... 12.95

Approximate total \$260.00

For complete circuit and details of necessary apparatus to make up this radio telephone set see Fig. 1, page 11, RCA Catalogue, which can be secured from your nearest dealer or by sending 25 cents direct to SALES DIVISION, Suite 1803

**Radio**  **Corporation**  
of America  
233 BROADWAY ~ NEW YORK CITY

# RADIO APPARATUS

**Largest Stock in Mid-West.**

**Immediate Deliveries.**

Our stock sheet issued monthly has met with so much favor, that we have decided to publish a part of it each month in "QST", for your convenience in ordering radio apparatus from us. Immediate shipment can be made on all items listed.

UV200 Radiotron detector tube ..\$5.00  
 UV201 Radiotron Amplifier Tube. 6.50  
 UV202 Radiotron 5 watt tube .. 8.00  
 UV203 Radiotron 50 watt tube ..30.00  
 UR542 Porcelain socket, Standard 1.00  
 UR541 Porcelain socket, 50 watt tubes ..... 2.50  
 UV216 20 watt Kenotron tubes ... 7.50  
 Acme CW inductance ..... 8.00  
 Acme Modulation Transformer ... 5.00  
 200 watt Acme CW transformer..20.00  
 500 watt Acme Plate Transformer.25.00  
 150 watt Acme Filament Transformer .....16.00  
 Ideal Filter Condensers 2000 Volts 2.00  
 UP1718 Grid Leak for 50 watt tubes ..... 1.65

UP1719 Grid Leak for 5 watt tubes 1.10  
 PR535 Filament Rheostat for 5 watt ..... 3.00  
 PR537 Filament Rheostat for 50 watt .....10.00  
 Dubilier Mica condensers, any capacity ..... 2.00  
 Dubilier Antenna series condenser three capacities ..... 4.50  
 Ideal Motor generators 500 Volt 100 Watt .....70.00  
 Ideal Motor Generators 500 Volt 200 Watt .....75.00  
 Log books ..... 1.50  
 Radio Corporation CW instruction book giving Hookups and information ..... .25

Complete stock sheet showing every thing worth while mailed free to any address. New CW and Radiophone catalog just out. Send four cents in stamps for it.

## T & H Radio Company

ANTHONY,

9ZAC

KANSAS



"Junior" 12c  
(including nut)

## 3 NEW LITTLE EBY'S, BOYS

Triplets? GOSH NO!!! Because—

2 are BLACK (Insulated) & 1 is WHITE (nickel)

Posts shown are our two latest "BLACK BEAUTIES" ("Junior" & "Junior H") and they sure are Beauts, too. Look just like our "Ensign" but cost less.

"BUDDY," our WHITE post, (not shown) is our latest metal post and it's a PIPPIN. It looks like our "Corporal" but is furnished with a stud and nut; now making it a cinch to mount. Price for "Buddy" complete, nickel finish 15c.

AT LAST! Boys, your long desire to equip your set with EBY posts can now be realized.

DEALERS & MANUFACTURERS— Order a stock of these LIVE sellers immediately at our usual attractive discounts.



"Junior H" 15c  
(including nut)

THE H. H. EBY MFG. CO., 605 ARCH ST., PHILADELPHIA, PA.

## KECO-RADIO STORAGE BATTERIES

Are the highest grade batteries built especially for wireless instruments.



Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristal" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, \$20, with book of uses and abuses of the storage battery.

**KALB ELECTRIC COMPANY**

7323 MANCHESTER AVENUE,

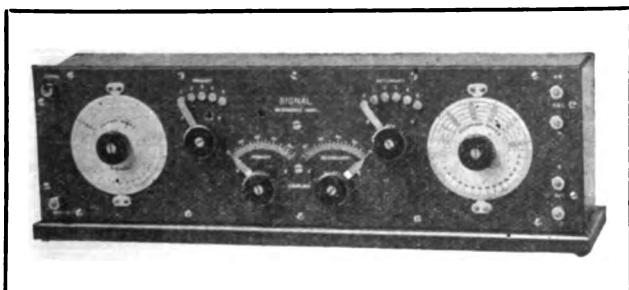
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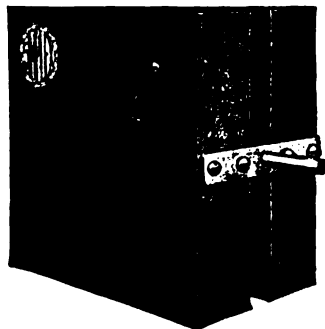
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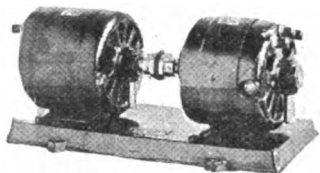
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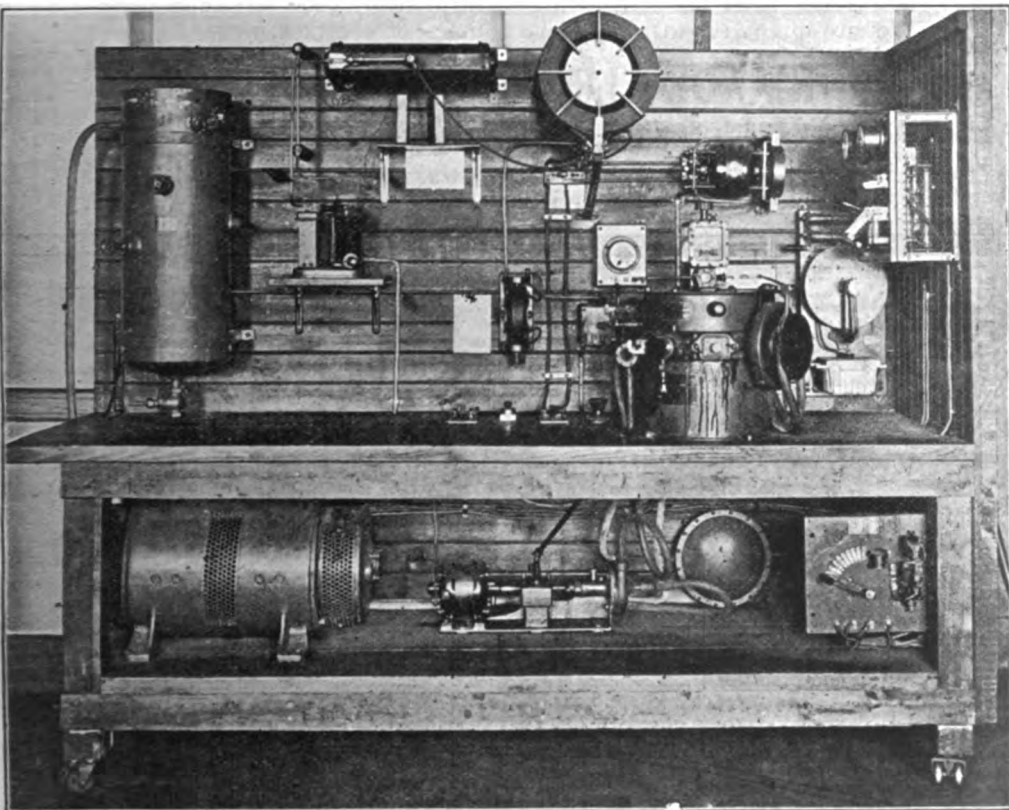
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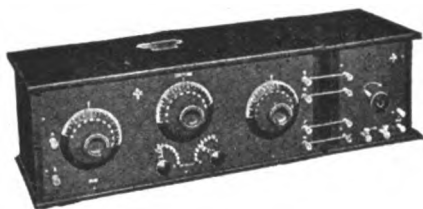
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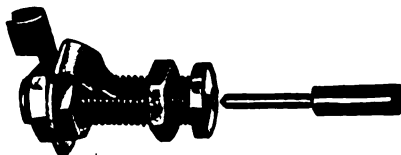
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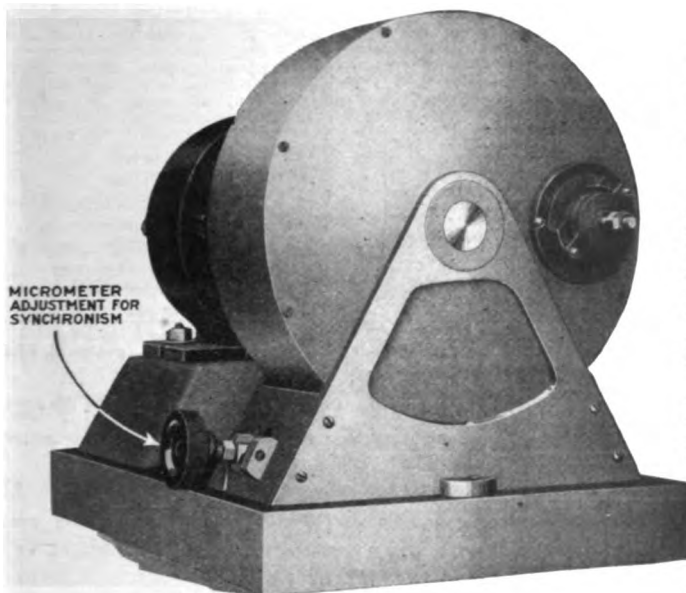
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**2nd**—Stationary electrodes may be adjusted to .001 of an inch by means of our micrometer adjustments.

**3rd**—Rotor turns on two ball bearings of one thrust type, one placed in the housing

and the other in the cover. A feature not found in any other type of gap.

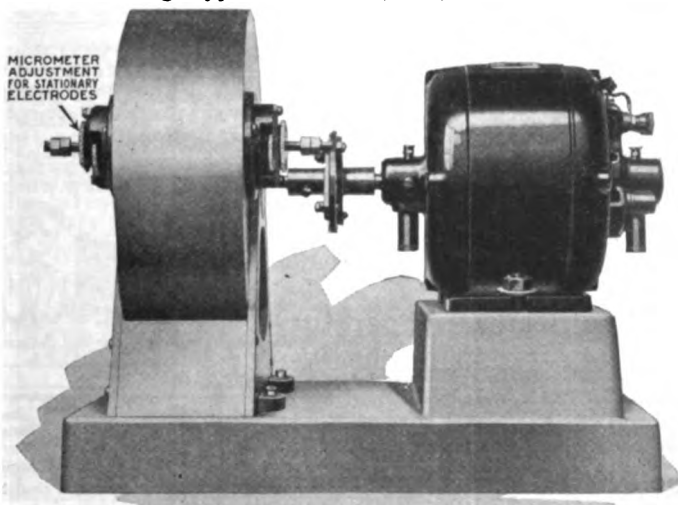
**4th**—Is of the "spark through" type (4" between outsides of adjusting lock-nuts).

**5th**—Excellent quenching because of large type rotor used ( $8\frac{1}{2}$ " ) and wide electrodes ( $1\frac{1}{2} \times \frac{1}{8}$ " ) giving a quick break.

**6th**—The Motor is an actual  $\frac{1}{8}$  HP and will come up to speed in about two seconds.

**7th**—The most silent gap on the market both during operation and while running idle. A feature which does away with the necessity of shutting down while receiving.

**8th**—The price is within reach of all tho the costly construction and quality of materials used, by comparison make this gap worth twice the price asked.



Gap and Motor Complete as illustrated.....\$65.00

Gap only..... 35.00

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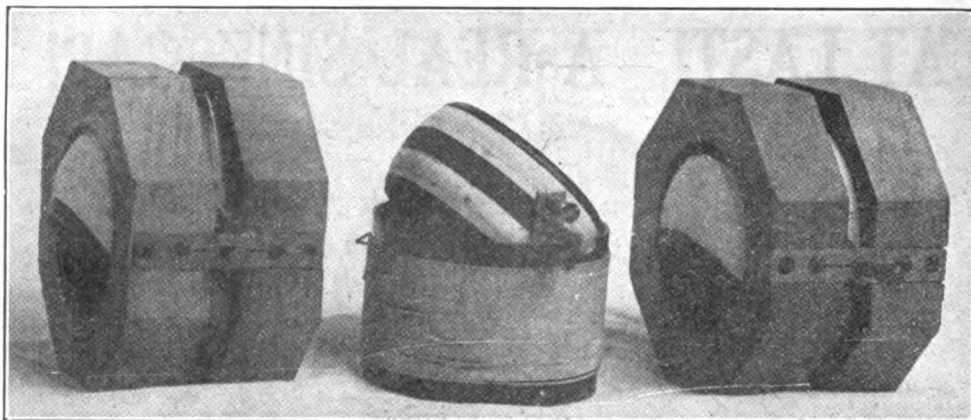
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Variometer, P-1 postpaid \$3.60

Vario-Coupler postpaid \$3.00

Variometer, G-1, postpaid \$3.60

### SPECIFICATIONS

Variometer forms 4 1/4 in. sq., 3 in. wide when assembled. Coupler primary 3 3/4 in. in diameter, 3 3/4 in. high. All shafts 1/4 in. diameter, 7 primary taps.

Range 150-475 meters. Special condenser to shunt secondary and increase range to 650 meters, supplied for 35c. extra.

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**DX AMPLIFIER**

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**DX RADIO COMPANY**

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**February 17 and 18, 1922**

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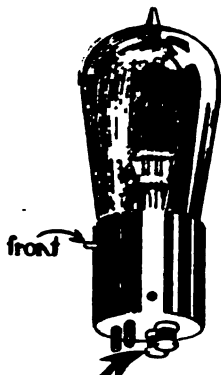
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Standing as an absolutely impassable barrier between the delicate filament of your tube and high amperage from any other part of your set the

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This fuse slips directly on the filament terminals of any standard bulb used in any standard socket and does not in any way affect the efficiency of your set.

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*Capacity 1, 1½, 2, 2½, 3 Amps. Size ¼ inch over all*

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**70Z—HAVE 1KW Quenched apparatus for sale cheap**—Want motor generator or CW apparatus. Lewis, 603 East 8th, Eugene, Ore.

**FOR SALE:** Mignon RW-4 Undamped wave Receptor \$50.00. Duck's 28" Loading Coil \$5.00. Ravenswood O.T. \$10.00. All A-1 condition. Write 9AIY.

**SELL:** Turney Spider-Web Tuner \$3.50; DeForest Gearcd Mounting, \$5.00; Chelsea 37 Plate Condenser \$2.50. Donald Detwiler, 1120 Va. Ave., Washington, D. C.

**GOVERNMENT GOODS CHEAP**—Insulators, \$0.60. 1 KW Keys, \$1.25; Leyden Jars, \$2.25; 1/2 KW Quenched Gaps, \$4.50; Protective device, \$4.25; .0035 French Dubiliers, \$8.50; Sperry arc transmitter, \$9.50; 6V. 400V. Dynamotor, \$22.50; 1/2 KW 600 cyc. French Portable, \$45; 1/4 KW 500 cycle motor generator, \$46; 1/2 KW Marconi 500 cycle Complete. Description on request. Eaton, 1915 South Twelfth, Philadelphia, Pa.

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**SELL:** Two variometers and coupler with condenser—150 to 650 meters, \$10. "Superior" phones with plug and jack attached, \$5. First money order takes them C. W. Copping, 2407 Valentine Ave., N. Y. City.

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**SALE:** Grebe CR3, \$45. Raymond Schlegel, 1118 N. Negley Avenue, Pittsburgh, Penna.

**SPECIAL DISCOUNT 5%** on all Radio Corporation, Westinghouse, Remler, Chi-rad, Acme, Baldwin, Clapp-Eastham, Murdock, Grebe, Jewell apparatus. See our ad December, page 118. This offer holds until further notice. Ask about our FREE CW offer. Hoopston Radio Shop, Hoopston, Ill.

**ASV**—Brand new 100 W. 500V., D.C. Robbins & Myers generator. A-1 condition, \$30. Am getting larger one. Write Harold C. Kauffman, 745 "A" St., Lorain, Ohio.

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**QST**—for sale at ur price—Murdock O.T. Manhattan 1 1/2" spark coil, 3/4" coil, Grebe RORA. 1JJ.

**FOR SALE:** 1KW Transmitting set, Packard Transformer, Dubilier Condenser, Hyrad Rotary, Thordarson OT, \$75; Honeycomb Tuner \$30; Audiotron Detector Cabinet including Tube \$15; 3 Step Amplifier including tubes \$25; Turney Spiderweb \$4. John L. Herzog, 1025 Gratiot Ave., Saginaw, Mich.

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**FOR SALE:** 1KW Coffin. Taken for \$55 F.O.B. Chicago. Beverly Radio, 1703 West 103rd St., Chicago.

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**SELL:** My 1/4 KW A-1 Transmitter at a sacrifice, \$30.00. Write H. J. Prebensen, Neenah, Wisconsin.

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**SELL:** 150-20,000 meter triple geared Receiver in-

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SELL: Navy Radio Material Telefunken  $\frac{1}{2}$  KW 500 cycle set, meters, gaps, inductances, transformers, motor generators, etc. Henry Kienzle, 501 E 84 St., New York.

NOTHING TO SELL, BUT my call has been changed to 8HM. (C.W.) Vincent, Old Sayw, Uniontown, Pa.

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FOR SALE: 1KW United Wireless Transformer \$40, 2 Condenser Jars \$3 each, 2 Condenser Tubes, \$2 each, rotary gap \$30, receiver and detector in same cabinet \$50, Acme detector \$8, Acme Amplifier \$9, Type C. Baldwins \$9. Jameson, 1019 Rex N. E., Canton, Ohio.

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SELL: Emerson 220 volt, D.C. motor. Practically new. Fine 500 volt Generator \$16. Everette Espy, Vandergrift, Pa.

FOR SALE: 1 KW Acme, \$20; Benwood Gap, (rebuilt) \$25; .007 Dubilier, \$30; Oscillation Transformer, \$5.00; Robbins-Myers Induction Motor, \$18. William Chinn, 2DK, Scarsdale, N. Y.

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THIS IS REAL DOPE: 7-22 stranded copper aerial wire 250 feet \$1.85; 500 feet \$3.50; No. 14 solid copper 250 feet \$1.15; 500 feet \$2.00; Magnet wire 50c per lb. and up. Add postage on wire orders. Send a stamp for our new bulletins. Wilmington Electrical Specialty Company, Dept. S-6, 706 Adams Street, Wilmington, Delaware.

FOR SALE: Paragon RA10 \$55. Price was incorrectly printed as \$35 in the December QST. J. F. Furey, 1 Magnolia St., Hartford, Conn.

STOP! LOOK! and ACT! VT's and Accessories. With each of the listed tubes—Radiotron UV200 \$5.00, and A.P. Moorhead Detector, \$5.00; Radiotron UV201, \$6.50 and A.P. Moorhead Amplifiers \$6.50; We will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat, \$1.00, No. 810 Remmler Bakelite smooth running rheostat \$1.00, R. C. of Am. Porcelain V.T. Socket, \$1.00, or Murdock V.T. Socket, improved contact type. Either of the Federal single, closed or double circuit jacks, listed respectively at \$0.70, \$0.85, and \$1.00, will be given as premiums with each R. C. of Am. Amplifying transformer UV712, \$7.00 or Federal Amplifying transformer \$7.00. FADA 5 Ampere Nichrome power rheostats \$1.35, or R. C. of Am. Porcelain V.T. Socket, supplied free of charge with each \$8.00 UV202 5 watt Radiotron power tube for CW or Radiophone Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returned within five days replaced at once. All orders are filled within twelve hours and shipped post paid and insured, thereby saving time and money. Remember us. The Kohler Radio Laboratories, Dept. Q, Abilene, Kansas.

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RADIO STORAGE BATTERIES. 6 volt 40-60 amp., \$10.00; 6 volt 60-80 amp., \$12.00. All brand new and guaranteed. W. & G. Tufts, 336 Newbury St., Boston, Mass.

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**Washington, D. C.**

**February 17 and 18, 1922**

following the guide with the white badge and the

**A. R. R. L.**



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to find instantly, complete data on any station you ever heard or worked. The "RADINDEX" (Radio-Index) Card Filing System is a necessity! Write for circular and sample card.

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**Quebec, Canada.**

#### **—FORMICA PANELS—**

Marked off, drilled, grained, buffed. Large holes cut for meters. Send drawing with exact dimensions for estimate. We guarantee quick service, accuracy and satisfaction.

**RADIO PANEL SHOP**

**1103 S. Third St.,**

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If you want to hear them, get our simple diagram and hook up advertised this issue under classified advertisements.

**VIRGINIA NOVELTY COMPANY**

**Martinsburg,**

**West Va.**

—FOR YOUR CONVENIENCE—

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ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



# CONTINENTAL NEWS

February, 1922

PUBLISHED OCCASIONALLY IN QST BY THE CONTINENTAL RADIO AND ELECTRIC CORPORATION

**I**F you want shipments, not promises; courtesy, not curtesy; action, not excuses; and good apparatus at a fair price—try “Continental Service.”

We can serve you efficiently by mail. Continental men understand your needs and are interested in making you satisfied. Look over this list and order direct from this ad.

## CONTINENTAL RADIO AND ELECTRIC CORP.

Dept. B-2

6 Warren St.

New York

### DUO LATERAL COILS UNMOUNTED

|          |        |
|----------|--------|
| U S— 25  | \$0.90 |
| U S— 35  | 1.00   |
| U S— 50  | 1.10   |
| U S— 75  | 1.20   |
| U S— 100 | 1.30   |
| U S— 150 | 1.40   |
| U S— 200 | 1.50   |
| U S— 250 | 1.60   |
| U S— 300 | 1.80   |
| U S— 400 | 2.00   |
| U S— 500 | 2.20   |
| U S— 600 | 2.50   |
| U S— 750 | 2.70   |
| U S—1000 | 2.90   |
| U S—1250 | 3.50   |
| U S—1500 | 4.00   |

### LOUD SPEAKERS

|                                     |         |
|-------------------------------------|---------|
| No. R-3 Magnavox                    | \$45.00 |
| No. 400-W Pleio-<br>phone           | 14.00   |
| No. P-2 Vocaloud<br>Station Type    | 30.00   |
| No. P-3 Vocaloud<br>Laboratory Type | 25.00   |

### PLUGS

|                                     |        |
|-------------------------------------|--------|
| No. 50 Pacent<br>Universal Type     | \$2.00 |
| No. 1428-W Federal<br>Brass         | 2.00   |
| No. 1428-W Federal<br>Silver Plated | 2.50   |
| No. 34-A Firco                      | 2.00   |

### TELEPHONES

|                            |        |
|----------------------------|--------|
| No. 56 Murdock<br>2000 ohm | \$5.00 |
| No. 56 Murdock<br>3000 ohm | 6.00   |
| No. 214 Superiors          | 8.00   |
| No. 213 Transatlantic      | 12.00  |
| No. 53-W Federal           | 8.00   |
| No. Type C Baldwin         | 12.00  |

### VACUUM TUBES

|                         |        |
|-------------------------|--------|
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| No. UV-201<br>Radiotron | 6.50   |
| No. UV-202<br>Radiotron | 8.00   |
| No. UV-203<br>Radiotron | 30.00  |
| No. A.P. Detector       | 5.00   |
| No. A.P. Amplifier      | 6.50   |

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|                            |         |
|----------------------------|---------|
| No. 10003<br>6 Volt 20-40  | \$14.60 |
| No. 10004<br>6 Volt 40-60  | 18.00   |
| No. 10005<br>6 Volt 60-80  | 23.60   |
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|---------------------------------|---------|
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| No. 9 Federal<br>Two Stage      | 58.00   |

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|                             |        |
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| No. A-2 Acme<br>Semi-Mtd.   | 5.00   |
| No. A-2 Acme<br>Unmounted   | 4.50   |
| No. 226-W Federal           | 7.00   |
| No. 10-T Creco<br>Semi-Mtd. | 3.25   |
| No. UV-712 R.C. Mtd.        | 7.00   |

### “B” BATTERIES

|                           |        |
|---------------------------|--------|
| No. 766 E R Large         | \$3.00 |
| No. 763 E R Small         | 2.25   |
| No. 2153 Burgess<br>Large | 3.00   |
| No. 4153 Burgess<br>Small | 2.25   |
| No. 8191 Cyclone<br>Large | 2.40   |
| No. 8190 Cyclone<br>Small | 1.25   |
| No. 100 Hipco Large       | 3.00   |
| No. 101 Hipco Small       | 2.00   |



# THE NEW ELECTRON TUBE For Radio Detection

The interest shown by the radio world in the new CONNECTICUT Electron Tube so far exceeded our expectations that it became necessary for us to arrange for production on a much larger scale than originally planned. This has meant unavoidable delay in deliveries.

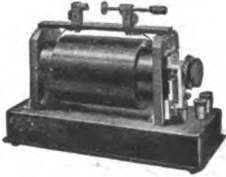
We have taken advantage of the delay, however, to make certain modifications in the operating design of the Detector assembly. The principle of the tube and its sensitiveness remain unchanged; but the new assembly will enable even the less skillful operators to obtain superior results.

The delay will therefore work to the benefit of users of the CONNECTICUT Tube. Watch for announcement of delivery dates in the next issue of QST.

**CONNECTICUT TELEPHONE & ELECTRIC COMPANY**  
Meriden Connecticut

# AMRAD

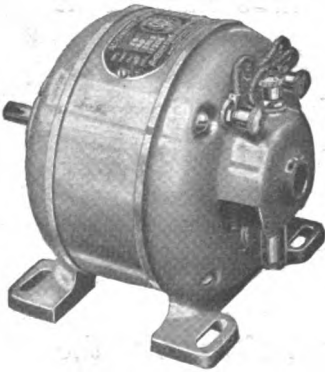
*The Recognized Symbol of Superior Performance*



Induction Coil, 100 watt 6 or 32 Volt—\$17.50



$\frac{1}{4}$  KW Quenched Gap \$10  
Coil and Gap Combination  
Special Price \$22.75



Synchronous Motor \$25.00  
1800 r.p.m.  $\frac{1}{4}$  h.p. frame

## LEADERS

**INVESTIGATE** these leading Amrad Radio Products at your nearest Dealer's. If he does not stock, he will get them for you quickly and save you Time and Money.

The new Amrad Variometers and Vario-Couplers, (exclusive Amrad basket-weave) the Verniers, and other popular parts for the operator who builds his own, could not be crowded into this small space. See them at your Dealer's. Or write us for descriptive literature.

The new "S" Tube—THE TUBE WITHOUT A FILAMENT—will soon be on the market as a Rectifier. The first month's production is already sold. You should IMMEDIATELY place your order with your Dealer to assure delivery.

For those desiring high class, efficient Receiving Units, at a reasonable price, nothing excels the Amrad Short Wave Tuners and Detector-Amplifiers described in Bulletin L-1. These are COMPLETE—in solid mahogany cabinets—the height of Amrad engineering.

Order from Your Dealer only. Bulletins describing any product illustrated mailed FREE. Send 10c in stamps for Complete Catalog.



Adjustable Load Coil \$3.85  
For wavelengths to 3000 meters



Fixed Condenser \$0.45 Seven Capacities, .0001 to .002 mfd.



Grid Leak \$0.65  
Six Values,  $\frac{1}{2}$  to 5 megohms  
Fits any Standard Mounting



Ampliformer, 2620, \$6.00  
Unmounted type, 2223, \$3.75

## AMERICAN RADIO AND RESEARCH CORPORATION

205 College Avenue  
MEDFORD HILLSIDE, MASS.

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Chicago District Office  
602 SO. DEARBORN ST.

# QST

DEVOTED EXCLUSIVELY TO AMATEUR RADIO

"HAMS ACROSS THE SEA"

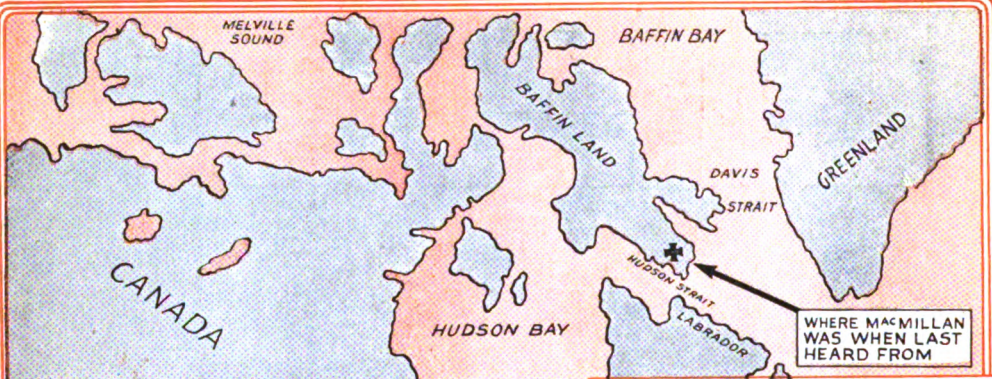
## QSR HAWAII

MARCH

1922

20¢





## FAR AWAY IN THE FROZEN NORTH

MacMillan's band set up its little wireless outfit and was delighted to discover that they could listen in on messages from twelve wireless stations in the civilized world.

—"Upon our arrival today 1224 geographical miles north of Boston, we tested our wireless and were delighted to hear at least a dozen stations. We hear the Annapolis station every day at noon and at 10 P.M. when time signals are sent broadcast. I think we are the first arctic expedition to ever keep in touch with home, (bringing to our minds possibly the fact that while we are apparently in a world unfinished or now long dead, far to the south of us there is another world, progressive and throbbing with activity.) The musical little note that reaches our ears nearly every minute of the day is a constant reminder that we are a part of the world and not forgotten

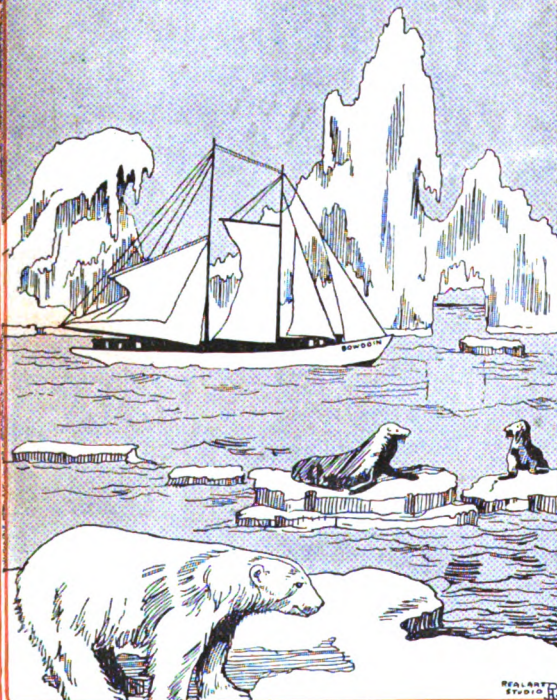
... "When in winter quarters we shall put up a larger antenna and undoubtedly keep in touch with home through the year."—Excerpt from MacMillan's story to the "Boston Globe", Dec. 4, 1921.

## THE RADIO EQUIPMENT USED BY DONALD B. MacMILLAN

was selected from the regular stock of the Atlantic Radio Company—not special equipment designed for his particular purpose. If this regular stock equipment is able to serve Mr. MacMillan so well under such adverse conditions—WHAT WILL IT DO FOR YOU?

**There is but one inference !**

*Send for our literature—it is free.*



**ATLANTIC RADIO CO. Inc.**

727 BOYLSTON ST., BOSTON, MASS.

15 TEMPLE STREET, PORTLAND, MAINE.

115 BRIDGE STREET, SPRINGFIELD, MASS.

# RAC-3 AUDION

**Price**  
**AUDION**  
**and**  
**Receptacle**  
**\$4.50**



**AUDIO**  
**FREQUENCY**  
**AMPLIFIER**  
  
**RADIO**  
**FREQUENCY**  
**AMPLIFIER**  
  
**AUDION**  
**OSCILLATOR**

**Full Size**

## FIRST UNIVERSAL AUDION

Manufactured under DeForest Patents No. 841,387 and No. 879,532

## RADIO AUDION COMPANY

**90 Oakland Avenue,**

**Jersey City, New Jersey**

No Radio outfit up to date without the RAC-3 Audion. No need for buying "soft" or "hard" tubes.

RAC-3 Audions are interchangeable without necessitating critical readjustments. RAC-3 Audions are not critical to A or B battery adjustments.

Low battery consumption. Filament current 0.8 amp. at 4 volts, maximum. Plate voltage 2 to 22 volts. Clear signals and great sensitiveness on long distance reception.

Perfect oscillation for use in regenerative circuits. Small size. Rigid construction. Non-microphonic. No tube noises due to mechanical vibration.

Maximum insulation between filament plate and grid terminals resulting from new type of tube and receptacle.

No soldered audion terminals.

Maximum direct mechanical contact between audion leads and receptacle clips.

Audion base caps and Receptacle block moulded Grade A Condensite.

Receptacle block is designed to permit built-up panel construction for amplifier panel. Circuit connections may be made from front, back or sides.

If your dealer is not carrying RAC-3 Audions in stock, send attached coupon.

### Mail Order Coupon

Radio Audion Company,  
90 Oakland Avenue, Jersey City, N. J.

Enter my order for.....RAC-3 Audions and.....Receptacles for shipment by return mail. Forward by Parcel Post insured. Enclosed herewith is Postal Money Order for \$ plus 10 cents for postage and insurance.

Name ..... Address .....

City ..... State .....

**ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS**



# Build Your Own Radio Tower

**T**HINK of the benefits and pride you would enjoy by having a real radio tower right on your own grounds. Think how much better you could hear and how much further you could send. Think how your reputation as a radio operator would travel through your community!

You can now build a tower yourself from standard materials which are all sold by your local dealers—build it from 40 to 100 feet high—economically and safely—from the easy-to-understand Hull blueprint plans that are as simple as A-B-C.

## CORRECT PRINCIPLES

For years we have been building heavy transmission towers for big central stations all over the country. Now we have started a department to permit radio operators to have the benefit of our tower building experience. At great expense we have drafted simple, yet detailed architects' blueprint plans for radio towers of seven popular heights. Every problem is properly covered—foundations, weights, stresses, wind pressures, etc. You do not have to figure out any sizes or what to use. Everything is shown plainly, right down to where and what size to bore the holes.

## YOU SAVE MONEY

Our plans call for everything that is best for strength, yet cheapest to use; you waste no money on useless parts. And, of course, because you build the tower yourself it costs you but a fraction of what you would pay for one ready-made.

## SIMPLE TO ERECT

The erection of your tower is simplicity itself. No long, awkward, heavy pieces are used; everything is light, strong and easy to handle. After cutting the pieces to size and boring the holes, you start building up and up, merely bolting each piece into position. You number each piece as you

make it, according to blueprint numbers—you can't go wrong. To the operator who likes to make things, building this tower will be real sport.

## SPECIAL OFFER

As a special introductory offer, for a limited time we have reduced the prices of all Hull radio tower working blueprint and erection diagram outfits exactly 50%:

40-ft. and 50-ft. Hull Tower Plans, regularly \$ 4.00—special \$2.00  
60-ft. and 70-ft. Hull Tower Plans, regularly \$ 7.00—special \$3.50  
80-ft. and 90-ft. Hull Tower Plans, regularly \$10.00—special \$5.00  
100-ft. Hull Radio Tower Plans—regularly \$12.00—special \$6.00

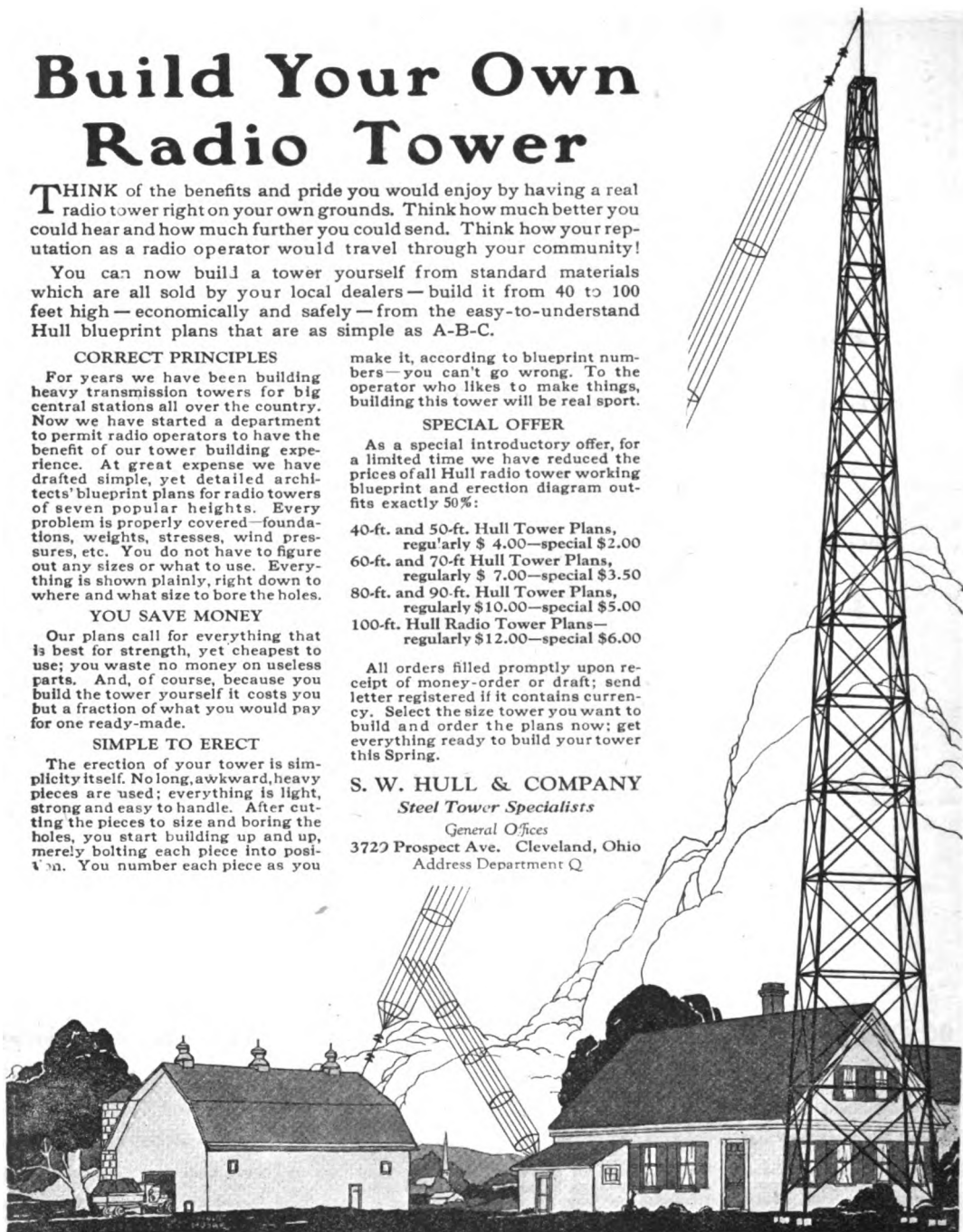
All orders filled promptly upon receipt of money-order or draft; send letter registered if it contains currency. Select the size tower you want to build and order the plans now; get everything ready to build your tower this Spring.

## S. W. HULL & COMPANY

*Steel Tower Specialists*

General Offices

3722 Prospect Ave. Cleveland, Ohio  
Address Department Q



# HULL

# RADIO TOWERS





## Will It Break When It Drops ? Not If It's Made Of Condensite !

The mechanical strength combined with its unusual insulating properties and attractive appearance makes Condensite the very highest type of insulating material in the radio field.

Moulded Condensite is fabricated by our licensed customers. Names on application.

Condensite-Celoron is a waterproof fibre manufactured by the Diamond State Fibre Co., Bridgeport, Penna. It can be obtained in sheets, rods or tubes in a variety of sizes and any quantity.

**CONDENSITE COMPANY OF AMERICA**

**BLOOMFIELD NEW JERSEY**

# Announcing the New All-Rubber Radio Battery



Here's a battery built *especially* for radio service yet with all the features that created the enormous demand for Willard Threaded Rubber Automobile Batteries.

There is not a bit of wood about this new battery. Threaded Rubber Insulation separates the plates. The case is a solid piece of hard rubber without a single joint. Both insulators and case are tested with wireless transformers at 24,000 volts, eliminating possibility of leakage from cell to ground or cell to cell and thus doing away with one of the most frequent causes of noisy sets.

Any of the 3000 Willard Battery Stations can give you full information about this new battery, or we will gladly furnish it direct.

**WILLARD STORAGE BATTERY CO.**

Cleveland, Ohio

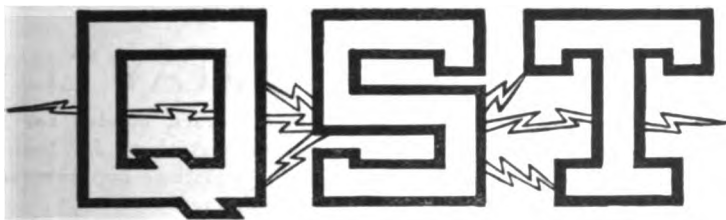
*Made in Canada by the*

Willard Storage Battery Co. of Canada, Limited,  
Toronto, Ontario

The Willard All-Rubber Radio Battery is made the right size for radio work, thereby reducing cost. Expensive and unnecessarily heavy connectors have been replaced by lighter ones, still further lowering the price at which you can get a genuine Willard Battery for your radio work.

# Willard

THREADED  
RUBBER  
BATTERY



# The Official Organ of the A.R.R.L.

VOLUME V.

MARCH, 1922

No. 8

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THE AMERICAN RADIO RELAY LEAGUE, Inc.  
HARTFORD, CONN.

# THE AMERICAN RADIO RELAY LEAGUE

"A national non-commercial organization of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave Radio Communication."

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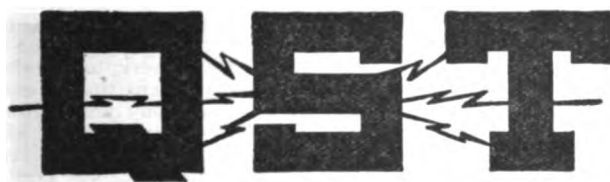
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A Magazine Devoted Exclusively to the Radio Amateur

## —And Now Transpacifics

**W**HILE Godley and the British amateurs were making history across the Atlantic in December another lone amateur in Hawaii was doing the same thing across a considerable portion of the Pacific Ocean and we have the honor of chronicling still another remarkable amateur achievement.

In the "Communications" department of QST last September we published a letter from Mr. Clifford J. Dow, 6ZAC, located at Wailuku, Maui, Hawaii, under the heading "Hawaii Getting QRV". Now Hawaii is almost QRV, as Mr. Dow has got his receiver in operation and has copied scads of American amateurs as far inland as Wisconsin and has received dozens of messages, proving irrefutably that it can be done. We have before us copies of Mr. Dow's log covering a period from December 14th to January 5th, during which time some two dozen stations were copied, most of them many times, including the following:

5XU, Austin, Tex., spark  
5ZA, Roswell, N. M., C.W.  
6XAC, Los Altos, Cal., Fone & C.W.  
6XAD, Avalon, Cal., C.W.  
6XAF, Oakland, Cal., C.W.  
6ZB, San Diego, Cal., C.W.  
6ZE, San Francisco, Cal., C.W.  
6ZR, Los Angeles, spark  
6ZAF, Berkeley, Cal., C.W.  
6ZAD, Napa, Cal., C.W.  
7JP, Astoria, Ore., spark  
7XF, Portland, C.W. & I.C.W.  
7YA, Boise, Idaho, spark  
7YG, Portland, spark  
7ZD, Bozeman, Mont., spark  
7ZJ, Vancouver, Wash., spark  
7ZP, Olympia, Wash., spark  
7ZT, Portland, spark  
7ZU, Billings, Mont., spark  
9GK, Neenah, Wisc., C.W.  
9ARJ, Hoisington, Kan., C.W.

9XM, Madison, Wisc., I.C.W.

9YAE, Le Mars, Iowa, C.W.

9ZAF, Denver, Colo., C.W.

He also reports the Army stations CL-8 at Camp Lewis Wash., and XF-1 at Langley Field, Virginia. The distance accomplished by the latter station is remarkable, even for its power—it has a 1 k.w. deForest radiophone operated at 500 watts as a C.W. telegraph set, putting 5 to 6 amps in an umbrella antenna and counterpoise at 375 m.

Most of the above copying was done thru heavy continuous QRN and in spite of tremendous difficulty encountered in the multitudinous harmonics of the Honolulu arc, NPM. Many of the stations are QSA and reliable; and A.R.R.L. message traffic has been copied solid from not a few; in fact, 6ZR, 6ZAF, 7ZJ and 7XF have been broadcasting messages "blind" to 6ZAC, and unless the arc interference and strays are too severe, Mr. Dow is copying them solid and acknowledging by cable or mail. 6ZAF and 6ZR particularly are practically in daily touch with him. As an example, we have received permission to publish the following message which was received by 6ZAF (Berkeley) from Pasadena on Jan. 16th and relayed to 6ZAC on the 18th, who delivered and acknowledged:

Mrs. Irwin Spalding,  
2376 Liloa Rise,  
Honolulu, T. H.

*Greetings from Pasadena via radio telegraphy by the courtesy of American Radio Relay League. Thank you for the book. It breathes the real aroma of the enchanted isles. S. G. McMeen.*

Commenting on the signal strength, Mr. Dow says that 6ZR of Los Angeles is the loudest station on the coast, and even beats KPH, the Radiocorp station at San Francisco; and in a letter to Mr. Babcock,

6ZAF, speaks of having him "in all over the house on two steps." 6ZR is using a 1 k.w. 60-cycle synchronous spark set on 375 meters, and 6ZAF is a 100-watt self-rectifying C.W. set using both sides of the 60-cycle supply.

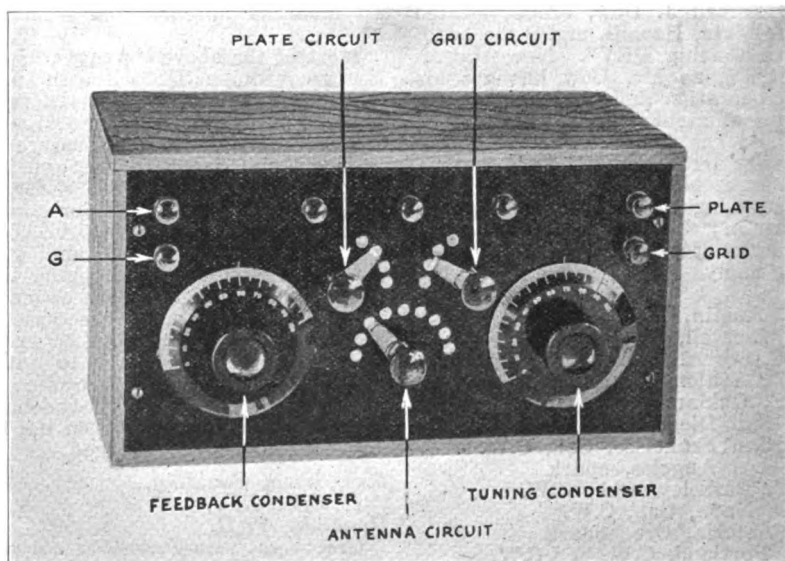
This reception has been accomplished on a simple amateur set using a detector and generally one, sometimes two, steps of audio amplification. 6ZAC, on the island of Maui, is a little less than a hundred miles from Honolulu, or about 2200 miles from San Francisco by the Great Circle route. The reception of 9th district signals, then, is a particularly impressive achievement. (All 9's heard were C.W.)

Mr. Dow is now building a 100-watt C.W. set, a duplicate of 6ZAF, and expects to connect up with the west coast soon. It will require some real co-operation among our fellows there, to get thru the QRM, but we are confident that it can be done. Then how for a relay from Honolulu to London, fellows? Or what's the matter with Capt. Norman Lee Baldwin, recently of 5YH, Camp Pike, Ark., but now military attache at Pekin, and still amateurizing? And British amateurs can QSO east. Why not Pekin to The Hague, via A.R.R.L.? *That day is coming, men!*

## The Improved Reinartz Tuner

THE opening article in QST for last June described the construction of a tuner due to Mr. John L. Reinartz, 1QP of South Manchester, Conn., which while simple and inexpensive was greatly superior to anything else which had ever come our way in the reception of C.W. signals. Since that date some hundreds of enthusiastic letters from

functions aperiodically, resolving the tuning into the simple control of the secondary condenser; (2) feedback is accomplished by a combination of static and electromagnetic methods in an adaption of the system originated by Roy A. Weagant, Engineer, Radio Corporation, rather than by tuning the plate circuit, so that readjustment of the feed-back is not necessary for each



individual readers of QST report the construction of as many sets, which in every case are performing as well or better than we said, to the surprise and delight of their owners.

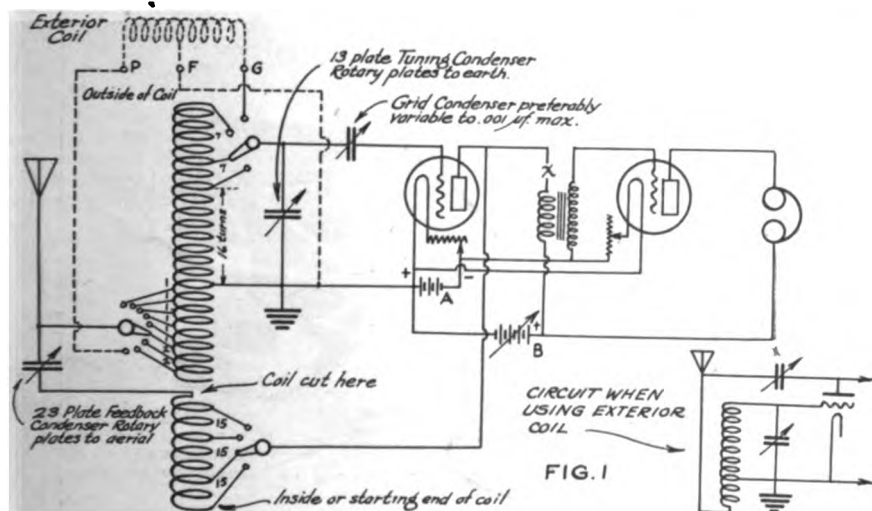
It will be remembered that the chief advantages of this set are (1) the primary

change in tuning; (3) hand capacity effects are practically nil. The result is that the feed-back may be set so that the tube is properly oscillating, and the tuning may be varied thru its entire range with the operation of but a single control with the bulb evenly oscillating; in fact, an adjust-

ment for best regeneration for spark signals may be set on the feed-back condenser and will hold good for a very considerable range of tuning condenser without further adjustment. It is in C.W. work that the set has its best field, however, and the possessor of one of these sets can generally pick up a dozen or so C.W. stations working within his tuning range and

is cut, this inner portion forming the plate inductance, but the remaining 40 turns are continued in the same coil and in the same direction, thus giving very tight coupling between the two sections. Taps are brought out to three switches as follows, and as is shown by figures on the diagram:

The plate winding is tapped at 0, 15, 30 and 45 turns, for feed-back control. Upon

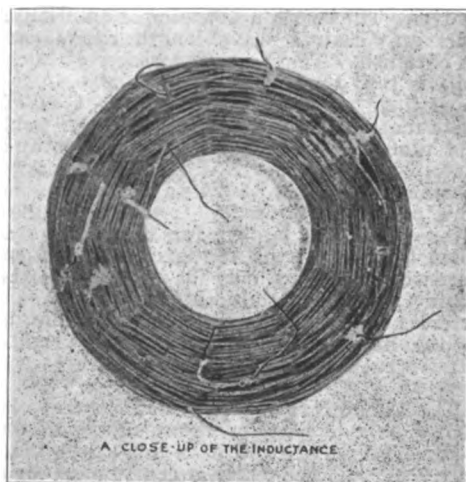


can stop at will on any one of them or return at will to any other, without the slightest fuss or inconvenience.

However, the reader is referred to the June article for a discussion of the principles and the operation of the set. This article is to present certain improvements that have since come to light. The original set had a fixed main inductance and a moving auxiliary inductance on each side thereof. The main expense and complication in the set entered in the construction and mounting of these movable coils. Mr. Reinartz, feeling that the most use of the set was being made by those who construct their own apparatus, accordingly has given thought to its simplification and has succeeded in doing away completely with the moving coils, the only inductance now being a single spider-web coil which can be made by anyone without difficulty.

We believe that the three photographs and the wiring diagram of Fig. 1 will give full information on the new tuner. In its main features it is the same as the old model. The new inductance is a spider-web consisting of 85 turns of No. 26 S.C.C. wire wound on nine "spokes" around a  $2\frac{1}{2}$ -inch center, the completed coil being about 5 inches total diameter. This gives a wave length range of from about 180 meters to 370 meters, thus taking in the concerts nicely. After 45 turns are wound, the coil

starting the second or outer section of the winding, taps to an antenna switch are taken off at the 2d, 4th, 5th, 6th, 7th, 8th, and 9th turn; and a ground connection



taken off at the 10th turn. Continuing the winding, taps are taken off for a grid switch at the 26th, 33d, and 40th or outside turn, for tuning purposes.

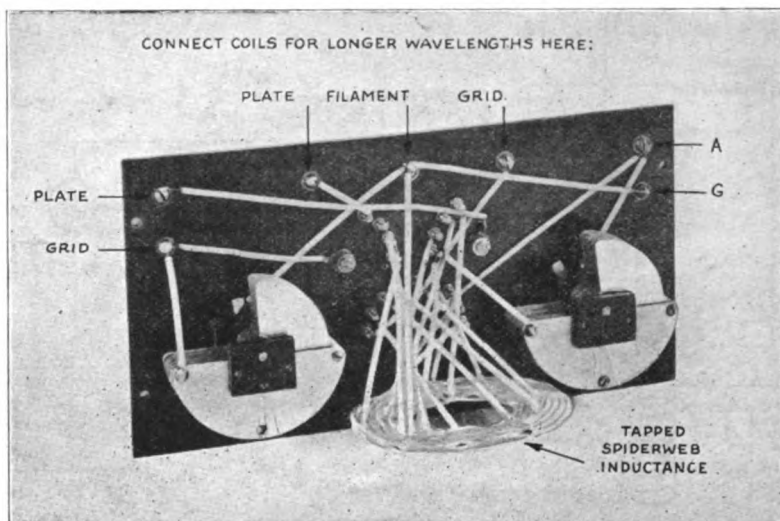
For the minimization of capacity effects



it is important that the rotary plates of the feed-back condenser be connected to aerial and the rotary plates of the tuning condenser to earth.

In Fig. 1 an extra switch-point will be noticed in the antenna switch and in the grid switch, and the plate switch also had a tap at 0 turns. When the respective switch blades are placed on these extra points, any desired exterior coil may be

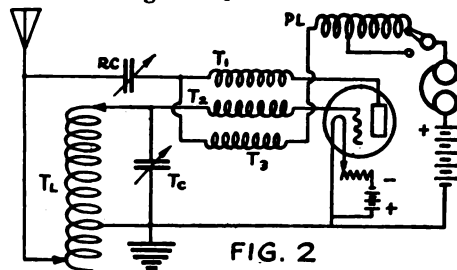
reactance of the primary winding of most amplifying transformers is so much less than the phones that when amplification is used it is found desirable to insert additional reactance, such as a small iron-cored winding of some sort, in series with the primary winding, as shown at X in Fig. 1. (Otherwise the filament would have to be crowded to make the tube oscillate.) Of course the most effective choke would be a



connected to the three binding posts provided at the top of the panel, the regular spider-web is cut out, and the new coil connected in to the tuning condensers and tube control. Thus with a few simple additional coils any desired wave length range can be obtained. The best disposition of such coils is that they have a tap at about one-third their number of turns, so that  $\frac{1}{3}$  of the turns may be connected between grid and filament and  $\frac{1}{3}$  between filament and plate. For 600 meter work Mr. Reinartz recommends a coil of 70 turns of No. 26 wire on a  $2\frac{1}{4}$ " cylinder (ordinary single-layer winding), tapped for filament at a point 50 turns from the grid end. Even long-wave stations may be copied in this manner. The circuit obtaining when an exterior coil is used in this manner is shown in the little diagram in the lower right-hand corner of Fig. 1.

The Reinartz tuner utilizes what is known as a parallel or shunt supply of its B-battery energy, and it is important that only the audio frequency currents pass thru it and that radio-frequency variations be excluded and caused to pass thru the feed-back circuit paralleling it. When only a detector tube is used, the reactance of the telephones generally is sufficient to choke out the r.f. in the B-battery circuit, but the

tuned trap consisting of a small coil and shunt condenser, capable of being tuned to the working wave, but this would involve an additional adjustment. Accordingly we are indebted to Mr. C. A. Briggs of Washington, D. C., for an interesting innovation designed to get around this trouble, and which will be of particular interest to the possessors of the original type of Reinartz tuner. In Fig. 2 the main inductance and



condensers and the two auxiliary inductances  $T_1$  and  $T_2$  are just as shown in our June issue. Mr. Briggs first added a tapped plate reactance shown at PL, consisting of approximately a hundred turns of wire on an oatmeal box, but found of course that at certain wave lengths the radio-frequency currents still leaked by.

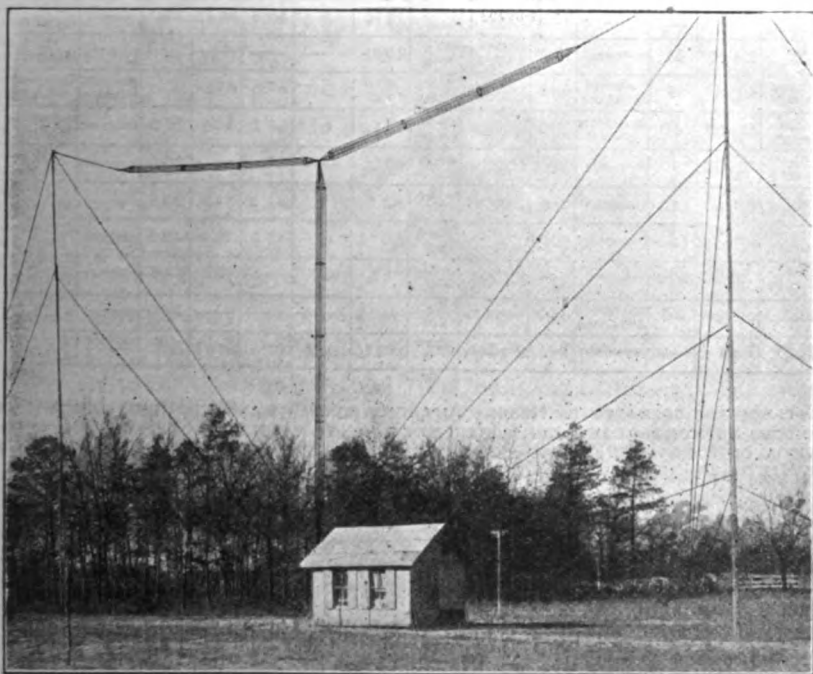
(Concluded on page 26)

# The Successful Transatlantic Stations

By Robert C. Higgy

THE recent transatlantic tests have brought benefits to us amateurs in many forms among which one of the most important is the data and information about the successful stations. A questionnaire was prepared and sent to all of the stations getting across and much valuable and highly interesting information has resulted. It is the object of this article to set forth a few of the outstanding features of some of the stations altho no attempt will be made to give a detailed description of all of the successful transmitters.

1RU of Hartford, Conn., is a fitting example of the average station and contains many features typical of all. It is the station of Mr. R. S. Miner and did some very excellent work prior to the tests. The antenna consists of a six-wire cage 80 feet long supported on each end by masts 54 feet above the ground. The lead-in is in the form of a six-wire cage eighteen inches in diameter running to the outside of the operating room. A counterpoise is used and is a duplicate of the antenna with the exception of being supported on spreaders. The transmitter uses a single 50-watt Radio-



2BML-2EH Antenna System

The accompanying tables have been prepared from the data received and from them may be gathered a skeleton description of each transmitter. The matter contained is for the most part self-explanatory and does not need further comment. The power outputs were calculated wherever possible by squaring the antenna current and multiplying by the total antenna resistance. The efficiencies could then be determined, since the output powers were known. In calculating the efficiencies, input power to the plates of the transmitting tubes only was considered.

tron in the reversed feedback circuit that has proved very popular of late. The antenna inductance consists of thirty turns of edgewise-wound copper ribbon which may be seen back of the panel in the photograph, and the grid inductance of the same type but smaller in diameter is mounted fixed within the larger antenna inductance. The panel was originally designed for a DeForest one-half-kilowatt tube. Its mountings can be seen back of the antenna inductance. On the panel are the filament ammeter, plate milliammeter and hot wire meter for measuring the antenna current.

## OUTLINED DESCRIPTION OF THE SUCCESSFUL TRANSATLANTIC STATIONS

| STATION  | ANTENNA                | ANTENNA HEIGHT | TOTAL LENGTH | GROUND COUNTERPOISE     | INPUT WATTS | TYPE AND NO. OF TUBES | PLATE VOLTAGE   | ANTENNA CURRENT | ANTENNA RESISTANCE | PERCENT EFFICIENCY | WATTS OUTPUT | WAVE LENGTH | CIRCUIT USED      | OWNER AND STATION LOCATION             |
|----------|------------------------|----------------|--------------|-------------------------|-------------|-----------------------|-----------------|-----------------|--------------------|--------------------|--------------|-------------|-------------------|--|
| 1AFV     | VERTICAL CAGE 12 WIRES | 70             | —            | COUNTERPOISE            | —           | 4-UV203               | 1000 C.R.       | 12 T.C.         | —                  | —                  | —            | 200         | REVERSED FEEDBACK | F.C. ESTEY SALEM, MASS.                |
| 1ARY     | T 4 WIRES              | 60-50          | 110          | COUNTERPOISE            | 300         | 1-UV203               | 1400 C.R.       | 4.6 HW          | 8                  | 56.4               | 169.5        | 225         | HARTLEY           | UNIVERSITY OF VERMONT BURLINGTON, V.T. |
| 1BCG     | T-CAGE 8 WIRES         | 108-75         | 170          | COUNTERPOISE 15 WIRES   | 990         | 4-UV204               | 2200 M.G.       | 6.0 TC          | 15.5               | 56.4               | 558          | 230         | MASTER OSC.       | *SEE FOOTNOTE GREENWICH, CONN.         |
| 1BDT     | T 7 WIRES              | 90-50          | 115          | COUNTERPOISE 18 WIRES   | —           | 1-UV202               | 400 C.R.        | 8 HW            | —                  | —                  | —            | 200         | HARTLEY           | S.S. HEAP ATLANTIC, MASS.              |
| 1BGF     | T 4 WIRES              | 40-40          | 100          | COUNTERPOISE 4 WIRES    | 150         | 1-UV203               | 1500 A.C.       | 2.7 HW          | —                  | —                  | —            | 210         | REVERSED FEEDBACK | P.F. BRIGGS HARTFORD, CONN.            |
| 1BKA     | FAN 15 WIRES           | 50-30          | 85           | —                       | 450         | ½ KW DEFOREST         | 1500 M.G.       | 5.2 HW          | 12                 | 73.7               | 332          | 225         | COLPITTS          | J.E. BROWN GLENBROOK, CONN.            |
| 1XM      | T 4 WIRES              | 100-30         | 100          | COUNTERPOISE            | 1000        | G.E. 2-VT-10          | 5000 A.C. 500-V | 8.5 T.C.        | 10.5               | 75.8               | 758          | 210         | HARTLEY           | M.I.T. SOCIETY CAMBRIDGE, MASS.        |
| 1YK      | CAGE 4 WIRES           | 27             | 155          | COUNTERPOISE            | 72          | 1-UV203               | 1000 M.G.       | 2.5 HW          | —                  | —                  | —            | 235         | HARTLEY           | WORCESTER POL. INST. WORCESTER, MASS.  |
| 1ZE      | FAN 22 WIRES           | 100-60         | 122          | COUNTERPOISE            | 450         | 2-UV203               | 1500 T.R.       | 7.0 HW          | 4                  | 43.5               | 196          | 375         | COLPITTS          | I. VERMILYA MARION, MASS.              |
| 1RU      | T-CAGE 6 WIRES         | 54-54          | 120          | COUNTERPOISE 6 WIRES    | 297         | 1-UV203               | 1350 M.G.       | 4.0 HW          | —                  | —                  | —            | 204         | REVERSED FEEDBACK | R.S. MINER HARTFORD, CONN.             |
| 1RZ      | T 4 WIRES              | 43-23          | 80           | COUNTERPOISE            | 150         | 1-UV203               | 1000 M.G.       | 3.5 TC          | 5                  | 40.8               | 61.25        | 220         | —                 | J.W. HUBBARD RIDGEFIELD, CONN.         |
| 2AJW     | CAGE 6 WIRES           | 73-53          | 84           | COUNTERPOISE            | 105         | 3-UV202 2-VT2         | 525 M.G.        | 2.0 HW          | —                  | —                  | —            | 200         | COLPITTS          | H.S. COLLINS BABYLON, N.Y.             |
| 2BML 2EH | T-CAGE 6 WIRES         | 60-55          | 95           | GROUND COUNTERPOISE     | 690         | 2-UV204               | 5000 T.R.       | 7 to 9 T.C.     | 7                  | 64.8               | 442          | 200         | REVERSED FEEDBACK | RADIO ENGINEERS CLUB RIVERHEAD, N.Y.   |
| 2FD      | T-CAGE 6 WIRES         | 80-50          | 140          | COUNTERPOISE 10 WIRES   | 500         | 1-UV204               | 3000 A.C.       | 7.3 TC          | 6                  | 64.2               | 324          | 200         | HARTLEY           | JOHN DI BLASI FLUSHING, N.Y.           |
| 2FP      | T 7 WIRES              | 70-70          | 100          | GROUND                  | 500         | 1-UV204               | 6000 A.C. 500-V | 5.0 TC          | —                  | —                  | —            | 200         | HARTLEY           | H.G. BARBER BROOKLYN, N.Y.             |
| 2ZL      | T 4 WIRES              | 85-65          | 120          | COUNTERPOISE            | 968         | 2-UV204               | 2200 A.C.       | 8.0 T.C.        | 7                  | 46.2               | 448          | 325         | —                 | J.O. SMITH VALLEY STREAM, L.I.         |
| 3DH      | CONICAL CAGE 6 WIRES   | 110-90         | 160          | COUNTERPOISE            | 700         | G.E. 250 W            | 3000 M.G.       | 5.0 TC          | 12                 | 42.8               | 300          | 225         | HARTLEY           | D.W. RICHARDSON PRINCETON, N.J.        |
| 8ACF     | V 7 WIRES              | 78-30          | 100          | GROUND                  | —           | 2-C302                | 550 C.R.        | 1.7             | 10.5               | —                  | 32           | 225         | HARTLEY           | MCMARY & HALL WASHINGTON, D.C.         |
| 8BU      | —                      | 30-28          | 80           | COUNTERPOISE AND GROUND | 150         | 1-UV203               | 1000 C.R.       | 4.6 TC          | —                  | —                  | —            | 200         | HARTLEY           | J.L. RUSSELL CLEVELAND, OHIO           |
| 8XV      | LOOP AND CONDENSER     | 65             | —            | COUNTERPOISE            | 980         | 2-500 W               | 3750 T.R.       | 15.2 TC         | 3.5                | 82.5               | 808.5        | 200         | —                 | F.S. MCCULLOUGH EDGEWOOD, PA.          |

\*1BCG WAS OWNED AND OPERATED BY MESSRS. AMY, ARMSTRONG, GRINAN, CRONKHITE, INMAN, & BURGARD. THE ABOVE DOES NOT CONSTITUTE A COMPLETE LIST OF THE SUCCESSFUL C.W. STATIONS. UV 202 NORMAL OUTPUT 5 WATTS; UV 203-50 WATTS; UV 204-250 WATTS C.R.-CHEMICAL RECTIFIER. T.R.-TUBE RECTIFIER

A relay, improvised from a telegraph sounder, can be seen mounted on the front of the panel also. Keying is accomplished by shorting a small-capacity condenser in series with the antenna, which lowers both the wave and power output when the key is up. Back of the main panel may be seen the filament-lighting transformer and the iron-core choke coils used for smoothing out the plate supply furnished at a voltage of 1350 from a motor-generator set. Prior to the tests distances up to 1800 miles had been covered frequently and very consistent work was done over distances up to a thousand miles.

2BML-2EH is the station of the Radio Engineers' Club of Riverhead, Long Island. The antenna, of which we are reproducing a photograph, is a six-wire cage 80 feet long with a cage down-lead in the center. It is supported by two wooden masts 60 and 55 feet in height and is in an excellent location. The transmitter consists of two 250-watt Radiotrons in a reversed feedback

circuit similar to that used at 1RU with the exception that the grid coil is not coupled to the main antenna inductance. The large inductance on the left is the antenna inductance while the grid inductance may be seen in the center of the photograph near the

## THE TRANSATLANTIC SPARK TRANSMITTERS

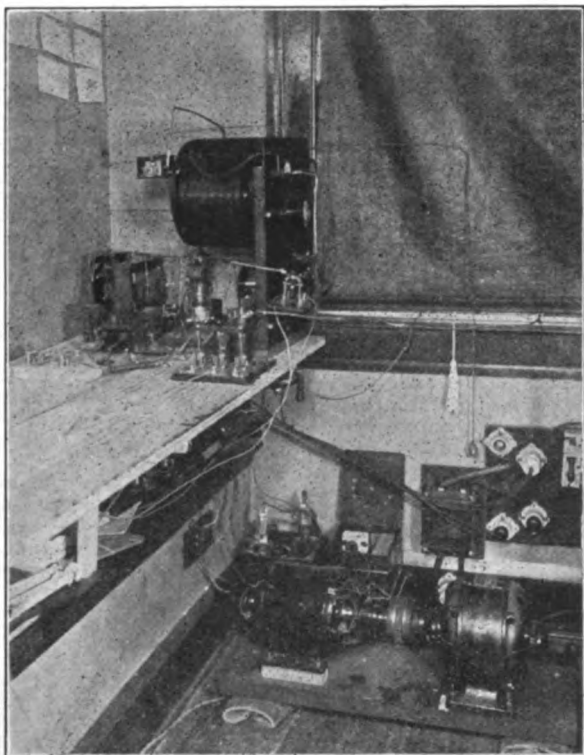
| STATION | ANTENNA      | HEIGHT | TOTAL LENGTH | WAVE LENGTH | INPUT WATTS | ANT CUR. | OWNER AND LOCATION                    |
|---------|--------------|--------|--------------|-------------|-------------|----------|---------------------------------------|
| 1ARY    | T 4 WIRES    | 60-50  | 110          | 200         | 1000        | 5.5 HW   | University of Vermont Burlington, Vt. |
| 1BDT    | T 7 WIRES    | 95-55  | 115          | 200         | 1000        | 6.0 HW   | S.S. Heap Atlantic, Mass.             |
| 2BK     | FAN 40000    | 75     | 105          | 203         | 800         | 5.8 TC   | C.E. Trube Yonkers, N.Y.              |
| 2DN     | T 4-17 WIRES | 95-75  | 125          | 200         | 700         | 3.0 HW   | Arnold Brilliant Yonkers, N.Y.        |
| 2ARY    | T 6 WIRES    | 60-40  | 80           | 208         | 1000        | 4.0 HW   | W.W. Radfern, Jr. Brooklyn, N.Y.      |

large variable condenser, which shunts it for variation in wave length. On the right are the two 250-watt tubes and in back of them are the Kenotrons which rectify the alternating current at 6600 volts supplied by the four large power transformers set-

ting on the floor. This arrangement gives approximately 5000 volts direct current, at which voltage the power supplied to the tubes is 690 watts. 2BML and 2EH are the same station and are operated by members of the Radio Engineer's Club. It has been one of the successful stations in the east and has a very good consistent range.

2AJW is the station of Mr. H. S. Collins of Babylon, L. I., and is a very good example of what the strong desire to get signals across the Atlantic can accomplish. The transmitter was composed of three 5-watt Radiotrons and three VT-2's, which Mr. Collins tells us had seen better days. One had no base, one a broken element, and the pet had a busted filament which had been shaken into contact and "spot-welded" many times before. Hard pressed for the little bottles, he put all of these in the circuit with a hope that they would shove a little more power in the antenna. The circuit was a Colpitts and as shown in the diagram. The antenna was a six-wire cage eighteen inches in diameter and 54 feet long, 73 feet high at one end and 35 at the other. A counterpoise was used consisting of various sizes of wire from 50 to 100 feet long in a fan-shape, ten feet above the ground. The plate supply was obtained from a small motor-generator giving 525 volts, at which the input was 105 watts to all six tubes. Mr. Collins has worked stations from Orono, Maine, to Orlando, Florida, and as far west as Detroit, while his signals have been reported at Eastland, Texas and Maplewood, Missouri. Just another example of the great efficiency of a little C.W. energy.

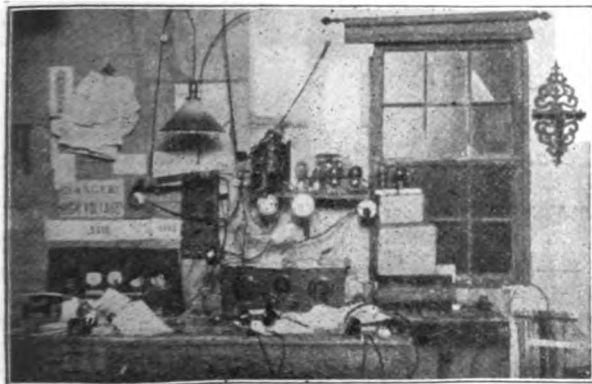
1YK, the station of the Worcester



1RU Transmitter

Polytechnic Institute at Worcester, Mass., is different from the other successful stations in many respects. The antenna is a four-wire cage 90 feet long and 27 feet above a copper roof to which it is connected through an inductance at the far end of the antenna. The free end of the antenna and roof are connected to the main inductance of the transmitter and form a large loop. The circuit is a Hartley for straight C.W. but for telephone and buzzer modulation is so arranged that the single 50-watt Radiotron may be used as a power amplifier, the oscillator and modulator tubes being of 5-watts output capacity. The plate voltage is obtained from the street railway line and a small generator in series, giving a total of 1000 volts. For the 5-watt tubes the small generator only is used. The inductance between the antenna and roof was adjusted so that the same current was flowing in each end of the system. Unfortunately the photograph submitted was not suitable for reproduction.

1BKA, the station of Mr. J. E. Brown of Glenbrook, Conn., used a standard DeForest one-half-kilo-



2AJW, Babylon, L. I.

watt transmitter. A fifteen-wire fan 50 feet high was used, being somewhat different from the other stations in that respect. The photograph needs no further comment as it shows the arrangement and types of the apparatus very clearly.

8XV was one of the stations erected particularly for the Tests. Construction was started but three days before the first night of the test schedule and quite a number of unexpected problems were encountered. Using two 250-watt tubes, supplied by approximately 5000 volts of A.C. rectified by tube rectifiers, trouble was found in the antenna insulators and it was necessary to use eighteen-inch insulators to stop leakage. The antenna current was 22 amperes on a thermocouple meter. In order to test the effectiveness of the transmitter and radiating system, a galvanometer was arranged in the receiving circuit at a station three and one half miles from 8XV and four miles from Mr. Conrad's station, 8XK. A deflection of 51 divisions was obtained when 8XK was transmitting and 35 divisions was obtained when 8XV was transmitting. The antenna was improved and later a deflection of 72 divisions was obtained, a change in height of but 22 feet making the additional de-



2BK's Ribbon Antenna

flection and also resulting in a lower antenna current of 15.2 amperes. The antenna is a loop condenser scheme and is of unusually low resistance, 3.5 ohms. Further details are lacking at this time. The tubes used were of a special type, designed for an input of 250 watts, but

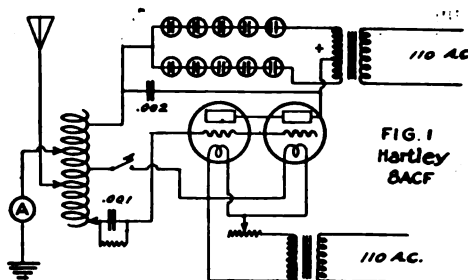


FIG. 1  
Hartley  
8ACF

approximately 500 watts were used in each tube. Recently two additional tubes have been added as modulators for telephone and exceptionally good distances spanned.

### The Spark Transmitters

There were seven spark transmitters that succeeded in covering the many miles to Ardrossan. One of these unfortunately cannot be located and at the present time, descriptions of but five are available.

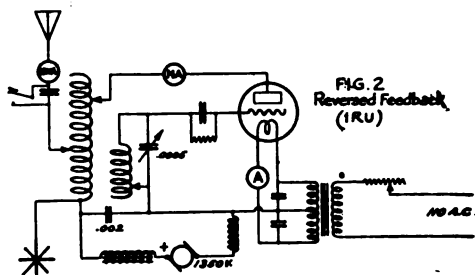


FIG. 2  
Reversed Feedback  
(1RU)

1ARY, University of Vermont at Burlington, Vermont, was one of the stations heard on both spark and C.W. The spark transmitter for the most part has been made at the University and comprises a one-kilowatt open-core transformer and variable series reactance for varying the power input, Murdock condensers, O. T., and rotary gap. The gap consists of two

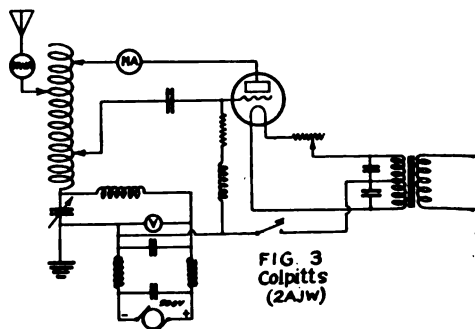
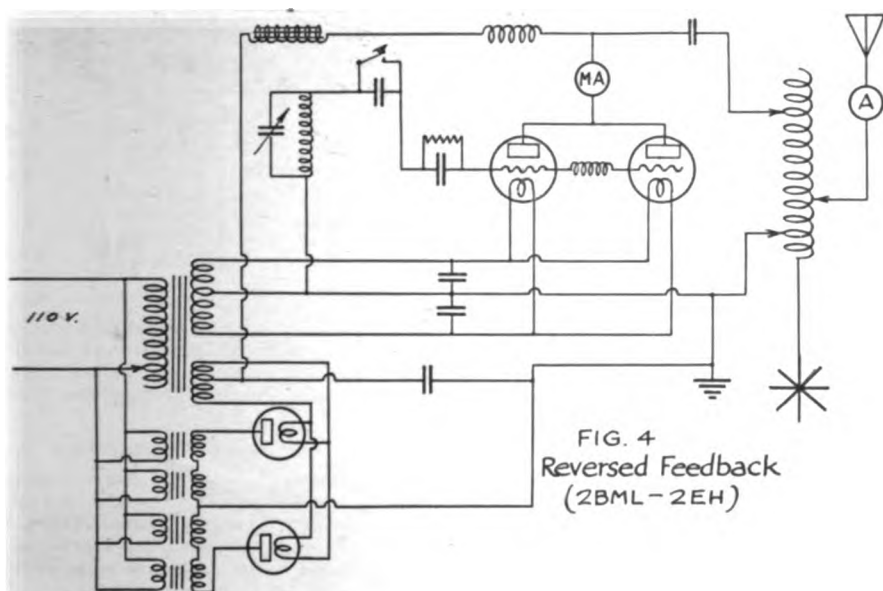


FIG. 3  
Colpitts  
(2AJW)



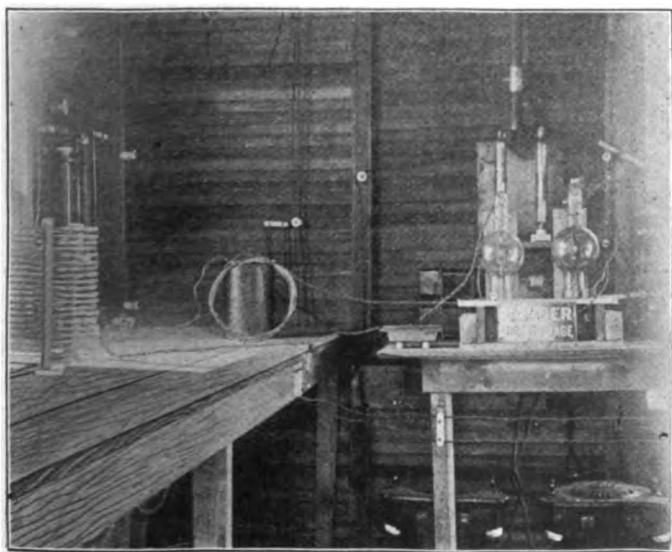
movable knife-edge electrodes of aluminum and twelve stationary brass electrodes designed to give a quick break. The C.W. transmitter uses a single 50-watt tube and needs no further comment.

2BK of Yonkers, N. Y., was another station erected solely for the tests. Mr. Trube moved his transmitter to the City's water tower and erected an antenna from

the top of the tower to a nearby telegraph pole. The antenna proper consisted of a four-ribbon horizontal fan 25 to 45 feet in width and 40 feet long at an average height of 75 feet. A radial 5-ribbon counterpoise 5 feet off the ground, 70 feet long and 72 feet wide, was used in addition to a connection to the water pipes and the tank in the tower. Brass ribbon was used

instead of wire and was one inch wide and .015 inch in thickness. The apparatus consisted of a one-kilowatt Marconi open-core coffin, home-made oil-immersed condenser, synchronous gap and O.T. A series condenser was necessary for operation on 200 meters on account of the large natural period of the antenna system. (215 meters). The photograph shows clearly the arrangement of the transmitter.

2ARY, originally reported as a C.W. station, consisted of a one-kilowatt Acme non-resonant transformer, home-made rotary gap having 14 points running at 1800 r.p.m., condenser using a Dubilier and Marconi jar in parallel giving a total of .01 mfd. capacity, and an O.T.



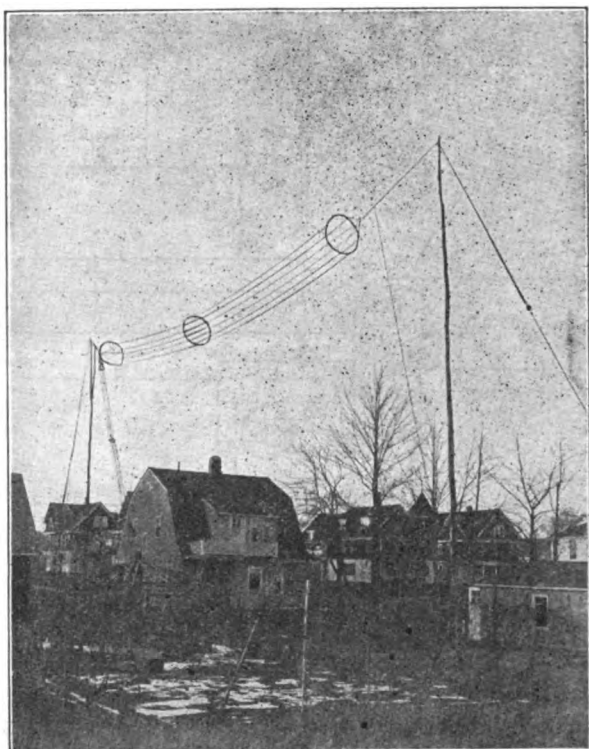
2BML-2EH Transmitter



2DN of Yonkers, N. Y., another of the successful sparks, contains many features typical of the average spark set. The antenna was an inverted L 30 feet between spreaders of 16 feet width. Four one-foot cages were used instead of the usual four wires. A small cage lead-in 95 feet long was used, the antenna being 95 feet high at the lead-in end and 75 feet high at the free end. Using a buried ground the total resistance measured approximately 12 ohms and an antenna current of 3 amperes was obtained on a wave length between 200 and 210 meters. The location is very poor, many large trees surrounding the antenna and a high hill to the eastward.

1BDT of Atlantic, Mass., was among those successful on both spark and C.W. Mr. Godley reports his signals as being exceptionally good in Scotland on the spark. Mr. Heap attributes much of his success to his unusually fine antenna and location. An inverted L 65 feet long of seven wires on 20-foot spreaders, 95 and 55 feet high, composes his radiating system, a small cage lead-in 50 feet long dropping from the flat top. The spark transmitter uses a one-kilowatt Acme transformer, oil-immersed condenser, a synchronous gap and home-made O.T. Antenna current approximates 6 amps. The C.W. set consists of a single 5-watt Radiotron tube in a Hartley circuit, supplied by 400 volts of chemically-rectified A. C.

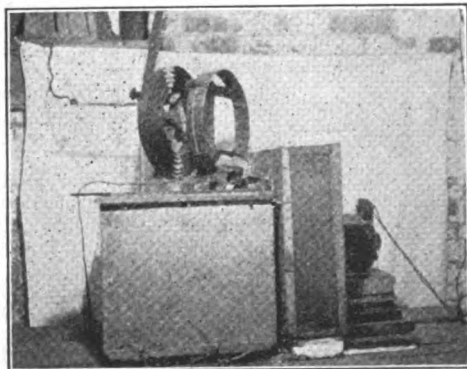
The January QST contained a description and photographs of 1AFV and the entire story of 1BCG was well told in the Radio Club of America paper appearing in our February number.



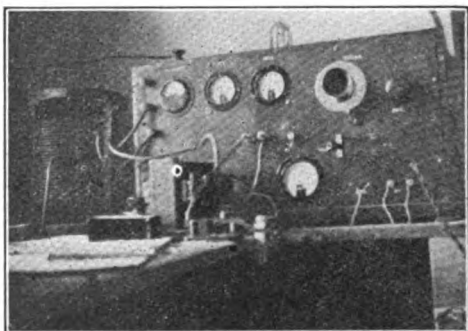
The Antenna at 1RU

### The Circuits

The circuit diagrams reproduced here are typical examples of the circuit arrangements used at the various stations. Figure 1 is a circuit known as the Hartley employing a direct-coupled inductive feedback arrangement. A chemical rectifier is used to rectify the high voltage alternating current supplied by the step-up transformer. Figure 2 is a reversed-feedback circuit that

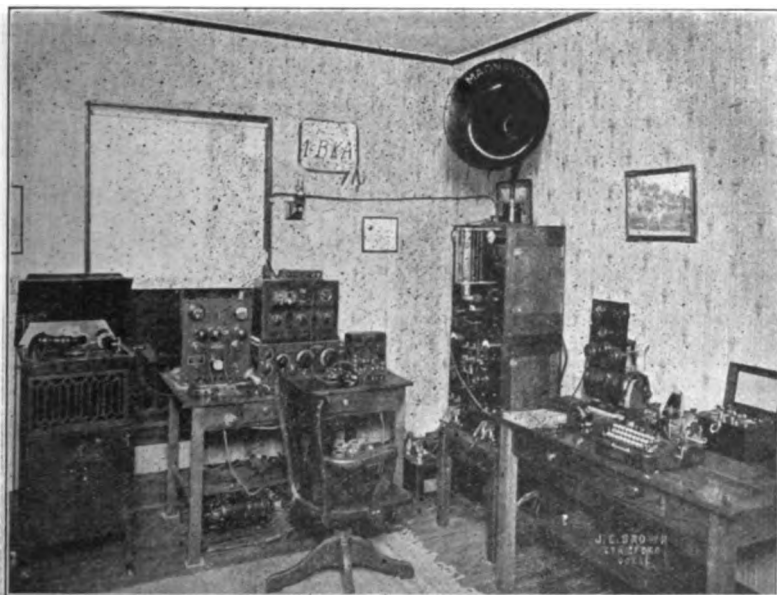


2BK's Spark Transmitter



The 50-Watt C.W. at 1RZ





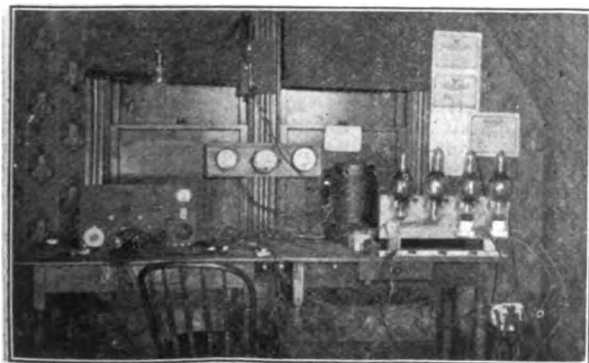
1BKA, Glenbrook, Conn.

was described in Mr. Whittier's article in QST for July, 1921. It has proved very popular and is quite efficient. Figure 3 is known as the Colpitts and is a capacitive feedback circuit, the series antenna variable condenser governing the feedback voltage. Figure 4 is the circuit used at 2BML-2EH and is a reversed-feedback similar to that of Figure 2 but the grid inductance is not coupled to the main antenna-plate inductance. Tube rectifiers rectify the high voltage alternating current supplied by four large commercial power transformers. Many articles have appeared recently in QST explaining more in detail the above circuits.

The results of the tests have shown that transmission across the Atlantic can be

accomplished with input powers of less than one kilowatt and on our low wave lengths. We have conclusive proof that C.W. was far more successful than spark not only from the standpoint of comparative efficiencies but also that of power outputs. It is interesting to note that no spark stations were heard by the British amateurs. Since the tests 1AFV (C.W.) has successfully transmitted messages on schedule to England, showing further that amateur transatlantic transmission is not an idle dream.

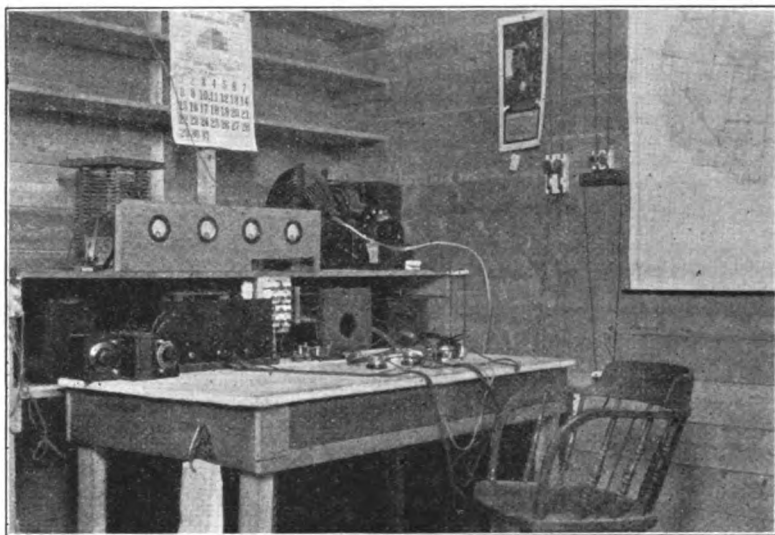
Much of the success was probably due to the high efficiencies and accurate adjustments of the participating transmitters, accomplished only by hours of careful study and work. While data in the efficiency column of the tables is somewhat incomplete and can only be considered as approximate, it shows remarkable values which were thought impossible a year or so ago. The single "5 watt tube" at 1BDT is a striking example of the possibilities of tube transmission and it is hard to believe it was heard in Scotland. The data in the tables are too incomplete to show anything further in common as to a definite reason for success. However much inconsistency is in evidence and contrary to what was generally to be expected, extremely low powered transmitters were successful in bridging the Atlantic.



8XV, Edgewood, Pa.

Most of us were a little too uncertain to predict that such small powers could cover over three thousand miles on schedule but

some of the stations had very poor locations, others good, one station will show a comparatively high antenna resistance and



1ARY, University of Vermont, Burlington, Vt.

we knew positively that some of our stations would be successful. Many of them had covered distances in excess of two thousand miles previous to the tests.

It is interesting to note however that

the next a remarkably low resistance; from which it is impossible to come to any further reasons in common for the success of the stations that bridged the Atlantic—except that 200-meter signals “do get out”.

## ***“And It Came To Pass”***

### ***The Parable of the Continental-Pusher and the Unfeeling Landlord.***

***By S. P. W.***

**A**ND it came to pass that a certain amateur, whose name mattereth not, having at last succeeded in getting his aerial just as he would have it, and a wonderful counterpoise system completed, was visited by his landlord who saith unto him all manner of unpleasant things, yea, even that his rent was raised fifteen per month.

And the ham taketh counsel with his so-called better half and she speaketh unto him words of wisdom, and many of them. Being wise in the ways of women, he departeth and inserteth an ad in the papers.

He getteth many replies and they visit many domiciles, but he findeth not what he seeketh, for it appeareth that two things come not together; and the names thereof are a Nice Long Backyard and a Decent House.

His wife wondereth exceedingly why he refuseth to be pleased and she pleadeth with him, saying, “Knowest thou not that our rent becometh due in four days?”. And she reproacheth him in many other ways of which wives know. But he remaineth firm and shaketh his head decisively, saying, I pay the rent and lo,

"I shall have what I desire!" And his Storm-and-Strife wondered exceedingly at his spunk.

And it came to pass that on the eve of the last day before the rent became due again that they explored a house in a splendid neighbourhood. And the house hath hardwood floors both upstairs and down and a fireplace and a built-in book-case which they both long after, and the walls were newly decorated, and the paint was fresh even unto the point of stickiness. The residence hath every modern improvement, even unto a burglar-proof locker in the cellar, yet the bulb-burner spreadeth gloom at every glance.

For he hath seen that the back yard is crowded with 110 and telephone wires, and that a power line drapeth itself near-by. He noteth with tears that elms of great age and altitude stand close by. He weepeth when he seeth a slate roof, which taketh not kindly to the erection of a mast.

And on the quiet he taketh aside the owner and asketh about an aerial (for hope springeth eternal in the breast of the ether-agitator!) and he waiteth with bated breath for the reply.

And the landlord scowleth dangerously, and growleth in a manner that fortelleth disaster, speaking of lightning and dangers of which he knoweth not that beset the property whereon wireless flourisheth.

And the wife entereth at this moment, and catcheth the word "Wireless", and lo, a great light breaketh upon her. And she saith unto the landlord, "We take this house!" and it was even so: they did! And those among you who be married know well why, for out of experience and suffering cometh the knowledge that when SHE speaketh thusly, it is exceedingly wise to obey, even unto the letter!



And so they moved into their new domicile and the wife rejoiceth exceedingly in the beauty of the place, but her husband faileth rapidly and mourneth continually.

For had he not torn down an aerial that

was a wonder, and torn up a ground that would have pleased even Warner? And had he not been forbidden to erect an aerial? He reflecteth that Job had an easy time after all; and he trieth divers means of erecting aerials that would escape the attention of the landlord.

He stringeth up an aerial in the attic, and on a rainy day the wash-lady hangeth her clothes thereon to dry. And the wires,



being but lightly attached, hold not the weight put upon them, and they break loose. The clothes thereon trail over a dusty floor and become exceedingly soiled.

The wash-lady becometh disgusted and quitteth her job, and the wife of the circuit-hound becometh exceedingly angry and reproacheth him saying, "Thy foolishness hath caused me to lose the best wash-woman in the city!" And she weepeth and refuseth to be comforted with less than a twenty-five dollar hat.

So he trieth a spiral cage antenna and placeth it in a large closet, saying naught unto his wife. But the next day she discovereth it and layeth violent hands upon it; so that when he returneth at evening he findeth only a tangle of wire. And when he attempteth to bawl her out she rareth up and saith, "Thinkest thou in thy ignorance that thou canst clutter up one of those wonderful closets with that mess of wire?" And he, being aware of the value that women-kind place upon closets wherein they may hang their finery, saith nothing, as was wise, for what profit it a man to speak in a case like this?

And in the days that followed he trieth many and divers aerials, and he runneth in bad luck always in this wise: He hooketh onto the eave-trough, and that night it raineth and the water followeth the wire thru the open window and on to a Persian rug that his wife cherisheth above all things. He useth condensers and connecteth onto the telephone line; but his set regenerateth exceedingly and the howls thereof

(Concluded on page 26)

## The European Transatlantic Results

**I**N the issue of "The Wireless World" for January 21st Mr. Philip R. Coursey, in charge of European arrangements for our Second Anglo-American Transatlantic Tests, reports on the results achieved by the British amateurs.

All the reports were not yet in at the time of writing but it was possible to say that signals from American amateurs were heard there by eight British stations, and some signals were also heard at The Hague (Holland) and at Nice, France. British amateurs picked up the complete and correct code-words from stations 1AFV, Salem, Mass., 1ZE, Marion, Mass., 2BML, Riverhead, L. I., 2FP, Brooklyn, and 2ZL, Valley Stream, L. I. Calls were also heard during the free periods from 1RU, West Hartford, Conn., 1BCG, Greenwich, Conn., 1UN, Manchester, N. H., 1XM, Cambridge, Mass., 2ZC, South Orange, N. J., and 2RU (?), the last one being uncertain. 1BCG was heard by five of the British amateurs, due to its prolonged calls. Commenting on this station's signals, Mr. Coursey says:

"While doubtless of considerable use to Mr. Godley, it is unfortunate that the signals from this station acted as a hindrance to some of the British amateurs, who picking them up, recognizing that they were of American origin and not knowing the special nature of the station [i.e., erected on Godley's recommendation, that he might have a known signal to tune to—Ed.], copied the repeated calls and messages for hour after hour during the best nights of the tests, to the complete exclusion of possible signals from other American amateurs—signals which must have been there had they been tuned in if the exceptional transmission qualities of those particular nights are considered."

Of those who picked up the signals, by far the best reception was made by W. R. Burne, of Sale, Cheshire, who heard seven stations, three on individual transmissions with the correct code-letters, and who has been awarded the British prizes allocated to the most successful reception of the signals. The value of these prizes seems to total in the neighborhood of \$600. Other prizes offered by British manufacturers for various performances have likewise been assigned to other contestants. H. H. Whitfield, of Hall Green, Birmingham, was second in merit, hearing two stations besides 1BCG, altho listening but two nights during the tests. Mr. W. Corsham, of London, Mr. R. D. Spence of Huntley, Aberdeenshire, Messrs. A. E. Greenslade and E. McT. Reece of London, Mr. J. R. Forshaw of Ormskirk, and Mr. T. Cutler of

Southampton, all heard at least one station during the tests. It is of interest to note that in all cases the aerials used by the British amateurs were within the limits imposed by their Post Office licenses and therefore much smaller than the system used by Mr. Godley.

Commenting in general on the tests, Mr. Coursey goes on to say:

"It is indeed fortunate that the tests on this occasion lasted for a longer period than last time, as the general results obtained by all stations, including Mr. Godley's, show that the signals were heard on a few nights only. Apparently at the beginning of the test period transmission was bad, but the signals gradually increased in strength during the next two nights and then faded right away again until nothing whatever was heard during the last nights of the test. Doubtless these changes were closely connected with the meteorological and other atmospheric conditions existing over the Atlantic at that time. This point is being investigated further, as the weather charts for that period are being collected. Had the tests only lasted the three days allocated on the previous occasion, it is quite likely that once again nothing would have been heard."

We are awaiting with interest information on the apparatus and circuits used by the successful British stations, and will endeavor to present some of this information to our readers.

### One of the American Stations Received in Holland

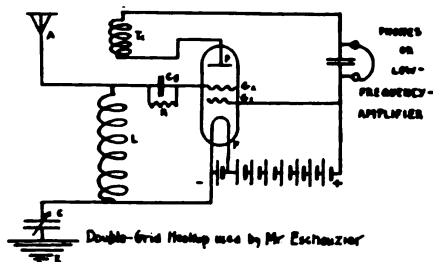
The following is a translation from the Dutch magazine "Radio Nieuws", organ of the N.V.v.R.T., sent us by Mr. Hatto Tapperbeck of Stanford University, Cal.

"During the period of the Transatlantic Tests Mr. Eschauzier, a Dutch amateur in The Hague, Holland, listening in eight nights succeeded in receiving the following signals at a wave length of 230 meters.

"On the night of Dec. 10, at 1:05 a.m. G.M.T. the word "test" was given several times followed by: "CQ CQ CQ de 1BCG 1BCG 1BCG test test rp rp rp", etc. At 1:50 a.m. G.M.T. the signals disappeared. The next night (Dec. 11) from 1:35 a.m. G.M.T. until 3:00 a.m. the same station was heard again sending: "MGES MGES MGES de 1BCG 1BCG", and at 3:00 a.m. G.M.T. again: "test test test de 1BCG 1BCG followed by: "MGES de 1BCG" and by "P.F."

"Dec. 12, at 1:35 a.m. G.M.T. 1BCG came in again with: "test de 1BCG PF PF PF Godley Godley Godley bi thirty minutes", repeating every word several

times. The same night at 2:30 a.m. 1BCG sends: "bi one hour" several times and stops at 2:35 a.m. Back at 3:35 a.m. send-



ing: "Test v 1BCG nr. 1.... Newcark.... to Paul Godley Ardrossan Scotland—.... congratulations.... Burghard Inman Grinan Armstrong Amy Cronkhite bi two hours, 1BCG". It stopped at 3:45 a.m.

G.M.T. and was heard again at 5:58 a.m., but too faint to receive more than: "nr 2 nr 2".

"Since Dec. 12, 1BCG has not been heard any more. The hookup below was used with a three-step low-frequency amplifier and a 60-ft. three-wire antenna 75 ft. above the ground and 30 ft. above the roof of the house.

"The reason for not receiving the text of nr. 1 completely is the fading away of the signals. This has been observed to occur periodically. The signals were very strong for 5 to 10 seconds, faded away, disappeared entirely during a period of 5 to 10 seconds and increased gradually afterwards to the maximum strength. Sometimes the signals held their maximum strength only for 1 to 2 seconds while they disappeared completely for about half a minute."

## The Radiophone and the Code Station

### An Argument for Co-operation

By S. Kruse

Here is a very splendid article on a phase of amateur work that is becoming decidedly important—the relation between amateur 'phone operators and dot-and-dash operators. This should not be confused with any C.W.-and-spark argument—"code station" means one using telegraphy, whether spark or C.W. Like all of our amateur problems this one melts into nothingness when co-operation, that much-used but invaluable word, is brought to bear upon it. Mr. Kruse points the way. Every amateur operator should read this article and take it to heart—it surely will result in untangling the local misunderstandings that now exist.—Editor.

IT has been the history of Citizen Radio that its accomplishment in any field is in proportion to the spirit of co-operation shown by its followers in the region considered. In the relay field Chicago occupies the position of "hub of the relay system" because there was first conceived in Chicago a fraternal system of club co-operation which aided the radio inspector in his duty of providing the best possible radio conditions by securing obedience to law. The "Chicago Plan" did not stop there but voluntarily provided time divisions for each class of station and required stations to adhere to those divisions, doing not only all that the law required but much more.

It was this fine willingness to allow the other man complete freedom over a part of the evening, to aid the inspector in limiting decrements and waves, that resulted in those splendid operating conditions that long distinguished Chicago from other cities.

Today this is widely recognized and city after city has adopted the Chicago Plan or some time division scheme that takes the

place of part of the Chicago Plan. In most cities it is not today considered courteous to operate a station all evening long nor in an improper manner and in quite a few there is provision that those who have not gentlemanly instincts will feel a force of public sentiment which they can understand.

It seems very peculiar then that there exists today such an amount of enmity between the radiophone men and the code men that they must indulge in acid correspondence thru our QST rather than to attempt thru those columns to establish that understanding which is rapidly being completed between local and DX, between spark and tube, and between spark coil and transformer.

Let us analyze the situation:—

#### The Code Station—Its Virtues

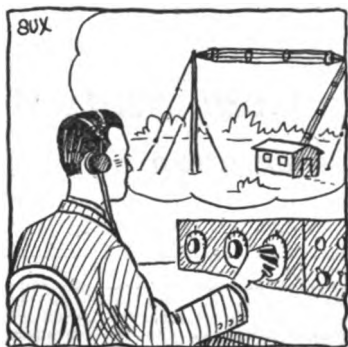
**Operation**—The code station begins with a low-powered set, increasing power and knowledge simultaneously. The small set usually belongs to a beginner and its smallness mercifully limits the amount of harm that ignorant operation may cause.

When the spark or CW set has grown larger the operator has acquired a device

with which more interference can be produced but at the same time he has learned to operate, and, if he be normally perceptive and equipped with those gentlemanly instincts referred to above, we find that he has learned to operate well. In this the code operator seeks justification to despise the inferior fone operator, whatever the latter's technical ability.

**Code Ability**—He understands both the code and the English language, hence can be reached by all classes of stations. Accordingly he cannot understand the man who knows but one language.

**Working Periods**—He works in short periods and of necessity listens between times to the reply of the other man, hence can be called if it is necessary. That anyone should send continuously causes the code man to rave.



In any city where the A.R.R.L. co-operative spirit has not utterly failed of appreciation he operates during a certain part of the day—the time agreed upon by his club for his class of station.

**Tone**—If it is spark or I.C.W. the tone is at least passable, for all its correspondents will "razz" a station with a bad tone.

**Back Wave**—Finally the set emits energy only when the key is down.

**Fraternalism**—Almost every code man belongs to a radio club, for in operating his station he has made many friends. He is accordingly alive to all transmission conditions and to any novelties or changes in citizen radio.

#### Code Stations—Their Defects

**Calling**—Code stations are very generally guilty of needlessly calling a station which two minutes' observation would prove to be unworkable thru QSS, QRN or QRM.

**Brevity**—Code men are almost all guilty of wordiness.

**Percentage of Listeners Who Are Interested**—The indictment can be brought against the code station that while (excepting NAA) its signals interest but one, it jams many.

#### The Phone Station

**Operation**—Phone operators often do not

build their sets but by them ready-made. Because of the tremendous carrying power of a small amount of C.W. the operator will cause long-distance interference for a while before he learns to operate. It is a fact also that a large number of phone men, because they have the technical knowledge needed to construct and operate a phone, assume that they are good operators. Now it can be put down as a nearly universal rule that a good laboratorian is a horribly bad operator; and nothing exposes his abysmal ignorance of operating ethics as does a radiofone. On the whole the phone operator is an inferior operator, weak on operating practice.

**Code Ability**—The usual fone man is a poor code man. In the course of operating he may become poorer, forgetting even the bit of code he knew when passing our foolishly-easy license examination. He works with other fones only or broadcasts without listening, and regards code as annoying and meaningless noise.

**Working Periods**—The radiofone seems to cause normally taciturn and reserved people to lose their reserve utterly, to talk much and to play their phonograph records over and over again. This is neither more nor less annoying than the long-winded spark. Club time divisions have in the past been ignored by fones. It is pleasing therefore to see that they are beginning to co-operate.

**Tone**—With the fone, "tone" means "quality of modulation". Here we have to make the first really important indictment of the fone. I am going on record as saying that I have so far heard but two fones, namely KDKA and 3NR, that were not open to material improvement in modulation quality. There are in use very many fones of both high and low power whose modulation is wretched.

**Back Wave**—Many fone stations are allowed to radiate while no sending is being done, while the operator is resting or while the phonograph is being wound. This is illegal and discourteous.

**Calling**—The fone usually does less foolish calling than the code set. It would distinctly be the better behaved if the operator knew a standard method of calling.

**Brevity**—Fone operators are usually even wordier than code men. The added speed of speech compensates for this.

**Fraternalism**—The fone man may or may not belong to a radio club. Not infrequently he appears to regard the code man as an inferior and to flock by himself.

**Percentage of Listeners Who Are Interested**—A broadcast fone if properly operated can claim a very high percentage of its hearers as interested listeners. A conversation fone, used as a code set would be used, ranks right with those code sets unless it can prove a superior sharpness that will result in fewer unwilling listeners.

### A Plan of Co-operation

It has now become apparent that interference cannot be avoided between the two types of sets unless some changes are made, and further than these, changes must be made in

- A—mental attitude of the operator
- B—operating practice
- C—sending equipment.

**A—Mental Attitude**—Neither the fone nor the code station has in the analysis proved itself alone perfect, nor has either brought any paralyzing indictment against the other.

It follows that both have a right to existence and that neither should attempt monopoly. To deny this is to prove one's utter selfishness. The practical applications of this principle are these—

The code man must abandon his attitude that the fone is a toy to be lumped with the spark coil and consigned to the local hours just after supper. Phone broadcasts have a very widespread audience; it would not be surprising if even today KDKA's audiences are larger than those of NAA. In turn the fone man should recognize the fact that code is not being sent to jam someone's broadcasting but that the operator of that code set is doing a thing the fone man and his set are not capable of unless they have greatly superior power—he is with a few watts of energy conducting a conversation with an unseen friend five hundred miles away. Also the code man is doing this thing according to an internationally known system that is a grand mystery to the fone man and is doing it in accordance with his local club's rules of time division, hence is in a large measure justified in jamming a phone which has not asked for a place in the ether.

It will help both men to appreciate each other's right to a place in the radio game if they will consider each other's attainments. To the spark operator the fone man is a "ham", "punk" or "lid" because he cannot send or receive properly and often violates the recognized courtesies of the ether. To the technician who operates a phone the code man is an ignorant brass-pounder. But the former overlooks the phone man's superior technical ability and the latter overlooks the code man's amazing store of knowledge of operating conditions, his pride of trade in his operating ability, his co-operative governing schemes, his fine gregarious sociability. Evidently the two ought to meet—they would then understand each other.

There we have the crux of the mental attitude matter; both the fone man and code man should belong to a radio club and should visit each other's stations.

In no other way will either learn that the depth of his own ignorance nor the attainments of the other.

A time division should be discussed between them and broadcasts confined to that time, no other sending being done. That method has solved the other interference problems and will solve this comparatively simple one.

**B—Operating Practice**—The department will correct itself if the basic principle of a friendly attitude can be driven home. Nonetheless we may point the way.

To earn his place in the ether the phone man should develop operating ability. A man who stands before a microphone and says "Hello-Hello-Hello-Hello! 1-2-3-4-5-6-Hello" is stamping himself as an ass before a large, tho unseen, audience. The man who makes long-winded, incoherent speeches over a broadcasting fone makes a public fool of himself, and it is almost certain that both will cap the performance by not signing off at all or by giving a firm's name, whereas it is definitely illegal to fail to sign one's proper call. The fone operator should listen to well operated code and fone stations, should question more experienced men and read the radio laws regarding methods of calling and signing.

There should really be defined in law a standard method of fone calling but until there is, an A.R.R.L. method is urgently needed.

The phone operator furthermore should be a code man capable of code reception and (as the law requires) should interrupt broadcast programs 3 minutes out of each 15 and should *shut off his tubes* whenever not actually talking for a few seconds.

The code man on the other hand can with profit learn to observe before calling and to be brief.

That is a short paragraph but its observation would reduce transmission 90%. The major portion of the code clan is chronically afflicted with "callitis", the key having an attraction like that of a bright bit of glass to a blackbird. But it would if they would just observe the second rule.

**C—Sending Equipment**—The code man and the fone man both can help greatly by a critical inspection of their own sets.

The precautions to be observed on the spark are too obvious for discussion.

Tube men as a rule blandly assume that their sets create no interference because they are "so sharp". That notion needs violent treatment. A tube set of any power throws a dense blanket over spark reception nearby. It is in order then to keep that C.W. blanket spread out as small a part of the time as possible. Fones should accordingly be equipped with readily accessible and easily operated plate power switches and C.W. code sets should *never* use a compensating wave.

A tube set also jams C.W. and fone reception on its own wave. It is necessary to make sure that the wave is really sharp. Now it happens that the frequency gener-



ated by a tube set is shifted by some systems of modulation so that the carrier wave itself is "waved" back and forth, hence broadened. Similarly the frequency generated by a tube varies if the plate voltage

leaf from the same book and improve his range while decreasing interference by rectifying his plate power and by equipping generator or rectifier with an effective filter.



Every evening that Chauncey calls on Kid Kickback's sister all the bugs within range of the Kid's radiophone set nearly flop from the giggling hysterics

is changed, especially if the circuit has large inductance and small capacity (like our antennas). Hence the use of A.C. plate power makes a horrible mess locally compared to a C.W. set.

It can be put down as a general rule that anything superimposed on C.W. will broaden the wave and make it carry less effectively while creating more interference. The fone man will therefore see that, power being the same, he will always cause more interference than his code brother, hence he is really on the defensive in the QRM discussion. The C.W. code man can take a

Finally, let the code man investigate his keying system and the fone man investigate his modulation by going somewhere else and listening. They are promised a surprise. The spark man will hear defects in his tone, the C.W. man will find his wave jumping about and the fone man will hear modulation that is a horrid cartoon of what he thought he was emitting and which all had assured him was "pretty fair".

And now we have made the circuit and have arrived again at my text which was go and get acquainted with the other fellow and co-operate with him.

## Radio Below 200 Meters

By Boyd Phelps, 9ZT

**I**T is a very lamentable fact that all general amateurs should have to try to tune to 200 meters. It would be much worse if all of them were tuned to exactly this wave. The result is that many of them are tuned somewhat above 200 to get away from the QRM that would result if everyone was on the same wave. This tendency towards lawlessness is fast hurting citizen wireless.

The general amateur station license provides for wave lengths "not exceeding 200 meters" which leaves a vast number of available waves below this limit. If the regulations were changed assigning amateurs only the waves between 1600 and 1800 meters there would be a very definite number of stations that could work at one time. As it is now, there is no limit below 200 meters to which an amateur can go and

still be within the law. There is really an infinite number of wave lengths available and on the lower waves tuning is so sharp that several meters difference in wave length is sufficient to completely tune out a station.

Looking at the situation in a broadminded fashion, it appears ridiculous that out of the immense number of possible adjustments we should all strive for the same one. If we could spread out more and still be within our legal rights it would mean better working conditions, less cussing at QRM and QRN, more traffic handled, and at the same time provide an efficient way for our Canadian brothers to actually do DX on their 150, 100, or 50 meter wave assignments. Realizing the value of radio below 200 meters, let us plunge into the more technical details.

The chief difficulty in the minds of many is the thought of having to use an antenna only a few feet long and perhaps not extending up high enough to clear surrounding objects. The following method worked out by the writer obviates this great disadvantage.

A vertical wire grounded at its base as shown in Fig. 1 is the simplest oscillator. Here the current ( $I$ ) is greatest at the bottom and decreases to zero at the top while the voltage ( $E$ ) with respect to the ground is greatest at the top and decreases to zero at the bottom. It is hinted in several publications that this antenna may oscillate with other distributions of current as in Fig. 2 which illustrates the first harmonic of oscillation. The frequency is three times that of Fig. 1 for the same length of wire and the wave length is one-third. Other possible modes of oscillation have wave lengths of  $1/5$ th,  $1/7$ th,  $1/9$ th, etc. of the fundamental. The writer recalls, when a boy, of having shaken a long rope extending up to the top of a barn. By suddenly shaking the bottom of the rope back and forth rapidly and regularly the rope would be made to swing widely at some parts of its length and remain quiet at other even intervals in two, three, or four places depending on how rapidly the motion was started and sustained. This is analogous to what happens in an antenna when oscillating at a harmonic.

An antenna with a fundamental of 300 meters when excited by a straight gap was found to emit waves on 300, 100, 60, 43, and 33 meters. It is only necessary to excite the aerial at one of its harmonic frequencies to have it absorb and radiate energy on that wave. It was found that the ratio of one to three does not hold between the harmonic and the fundamental when the antenna is loaded. At 9FO with the large antenna having a fundamental of 350 meters the use of a series condenser was impractical for 200 meters. All of the secondary of the oscillation transformer was inserted, bringing the wave up to 525 meters; the first harmonic then increasing to 169 meters as determined with a spark gap in the ground lead and a spark coil connected across this gap. With the closed circuit carefully tuned to 169 meters and coupled to the antenna circuit good radiation was obtained on this wave length. Moving any clips on the O.T. caused a falling off of antenna current. With the wave meter coupled to the ground a sharp wave was found at 169 meters but no matter how close the wave meter was coupled to the aerial circuit no wave could be found around 525 which was the normal wave length of the open or aerial circuit. By the ordinary method of tuning it would be next to impossible to tune this station to comply with the law while now communication is

carried on thru QRM on 200 meters. This new method permits easy working on 200 meters and below with a large aerial.

It is perhaps not well to encourage the above experiments too much, especially in coastal cities, as inaccurate adjustments may cause a strong wave to be emitted at about 600 meters. The real value of this method of tuning comes in the use of C.W. A vacuum tube, we are told by many eminent experimenters, will in laboratory circuits oscillate at wave lengths of five

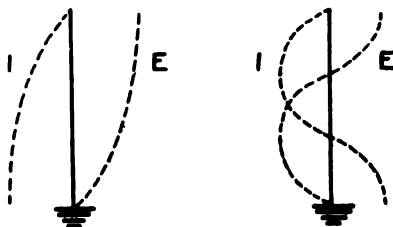


FIG. 1

FIG. 2

meters or less. Even at this low figure there are countless wave lengths still lower available under the general amateur's license so why all crowd around 200 meters and creep over? Tuning is extremely sharp at low wave lengths so that more stations may be accommodated at wave lengths differing but a few meters. For example, a change of from 10,000 meters to 10,001 meters means a change of but about 3 cycles per second while a change from 100 to 101 meters means a change of 29,703 cycles.

Any vacuum tube oscillating at these low wave lengths will cause the aerial to oscillate provided the aerial coupled to the tube circuit has a harmonic of the same wave length. Energy will be absorbed from the tube circuit and radiated at that wave length under these conditions. Circuits have been used with conductive coupling as well as inductive. It is not to be expected that the radiation ammeter will read as much on low waves as the current in an antenna varies inversely as the square of the wave length.

The writer has been greatly hampered in testing out transmitters on low wave lengths because of the few receiving stations that can get below 200 meters. The single circuit tuner with series condenser seems the best for reception below 200 meters. The ease of adjustment more than offsets the broadness of this type of receiver on low waves because most stations very much below 200 meters will be C.W. Vernier adjustments should be used thruout all tuning elements of the circuit. With the above tried at several stations the path will soon be broken for handling traffic on waves between 100 and 200 meters just as the path was broken by the pioneers in C.W. a year ago. Working on 150 meters now

is equivalent to a Z call and 375 meters, as far as interference is concerned. It is not expected traffic will move on low wave lengths for a while yet, but with the sharpness of tuning, the great decrease in atmospheric disturbances, and the crowding on and just above 200 meters, it appears that getting below is the logical solution of our problem.

### THE IMPROVED REINARTZ TUNER

(Concluded from page 10)

It then occurred to him to make these "leakage currents" do useful feed-back work and this he accomplished by making a third auxiliary coil,  $T_3$ , of some 25 or 30 turns, placing it in the phone (or primary transformer winding) circuit where it would be coupled to the grid auxiliary coil  $T_2$ , and completing the circuit to a point between  $T_1$  and the feed-back condenser RC. The new arrangement now works beyond criticism, and has resulted in a decided improvement in results.

### "AND IT CAME TO PASS"

(Concluded from page 19)

cause his neighbors disturbance when they would hold converse on the line, and the telephone company sendeth a man unto him who speaketh unkindly and threateneth to sue if the performance be repeated. And then he remembereth Major Squires, and he trieth a tree antenna, but the next day a junk man cometh and maketh off with the nice copper wire. And he buildeth a loop antenna which worketh not and stringeth up wires in the basement to no purpose.

And he sweareth to himself that next summer he will build himself a house of his own, and will have built into it a special sound-proof room. And there will be special wiring and fuse-panels, and on

the roof there will be a tower of great height. And the back yard will be two hundred feet long and treeless, and his aerial will be a thing of beauty to him and an abomination in the eyes of his neighbors who understand not the complex joys of radio.

And the dabbler in dots and dashes rejoiceth exceedingly in this vision, and in the meantime planneth new aerials and new methods of circumventing landlord of the Tribe of Damphools, for hope, as we have stated, springs eternal!

For truly, as was spoken by the prophets, "Necessity is the mother of invention, and he who trieth to repress a condenser-twirler is as one who maketh hooch and putteth in the stoppers too soon!"

Selah!

### A.R.R.L. Boosters

By L. Q.

OUR A.R.R.L. has two kinds of boosters and we love 'em both.

The first kind wears a QST in the coat pocket, a smile on the face, and fellowship in the heart. He whoops us up at every chance, converting to A.R.R.L. all within sound of his loud and joyous voice.

We love him for the new friends he brings.

The second kind makes no noise. But at the club door he grasps the star speaker's hand saying—"O.M., that was a fine talk and no paper but QST deserves it. Come over to the Allnite Lunch while we make a preliminary write-up." Then he camps on that trail until the paper goes to Hartford.

And we love him too, for he keeps our old friends with us and who shall say he brings no new ones?

Moral—Are you the first or the second kind of booster?

## An Improved Primary Condenser Switch

By Chas. T Jacobs

THE primary circuit of the modern receiver seems to include more often than not a variable condenser for tuning purposes. In most cases it is highly desirable to connect this condenser so as to be able to throw it at will (a) in series with the primary inductance, (b) in parallel therewith, and (c) out of circuit altogether. This is usually accomplished by means of flat spring switches on the surface of the control panel, either two single-blade two-point switches, or a double-blade eight-point switch being used.

Desiring to find a switch which would not take up so much panel space, yet at the same time be at least as convenient in operation as the usual types, the writer

resorted to the use of one of the anti-capacity switches on the market today. These have three positions, as required, but unfortunately for the work in hand are entirely open circuited in the middle position. The series and parallel connections can be obtained, but no plain connection of the inductance and omitting the variable condenser is possible without a change of some kind in the switch itself. A little experimenting revealed that by slightly bending two springs a switch could be obtained that would meet the requirements in every respect.

A side view of the spring assembly of a switch such as the writer used is shown in Fig. 1. It should be mentioned that his switch has two rows of six springs each,

instead of only one, as shown. The other springs would be directly behind those shown in the drawing. But only one row is necessary (though two rows could be used connected in parallel to reduce resistance, if desired) and only one row need be treated as described.

In the drawing, A and B are the movable springs, each exerting a pressure on wheel W, by the raising or lowering of which they are operated. Numbers 1, 2, 3, and 4 are stationary springs. When the wheel is

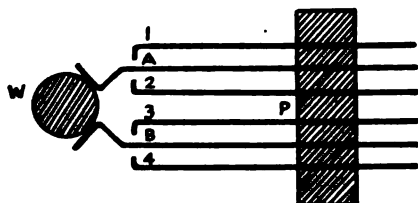


FIG. 1

raised by pressing down on the switch handle (not shown) spring A is forced against spring 1, and spring B is allowed to rest on spring 3, which it will do, owing to its tension. Conversely, when the wheel is lowered by raising the switch handle, spring A is allowed to rest against spring 2, while spring B is forced against spring 4.

To adapt the switch for the use under discussion it is simply necessary to bend up spring 2 so that it shares with the wheel the pressure of spring A, and to bend down spring 3 so that it shares the pressure of spring B. This is not much of a job if a small pair of pliers is available, but certain precautions must be observed if a satisfactory result is to be obtained.

First it is well to see that both springs A and B are exerting equal pressure against the wheel. In a single row switch this is easily determined by the switch handle, which should stand out straight. If it does not, bend one or the other spring at the base (P) till an equal pressure by both springs is indicated by the position of the switch handle. In a two-row switch it is necessary that in each row individually the pressure of spring A equal that of spring B. For this reason these two springs should be wedged apart in one row so that neither touches the wheel, and the two springs in the other row adjusted as in the single-row switch. Then the wedge is removed, and the springs which were wedged adjusted till the switch handle stands out perfectly straight. This insures a properly adjusted switch to begin with, and is important, as these springs are often affected by careless handling, etc.

Having equalized the pressure of springs A and B, and with the switch in the neutral, or middle, position, bend spring 2 at its base till its tip just touches spring A, and

no more. Then bend spring 3 till its tip just touches spring B. Now carefully bend each a shade further. Raise the wheel by pressing down on the switch handle, forcing spring A away from spring 2 and against spring 1. If spring 2 has been correctly bent it will start to move with spring A when the wheel is raised. This movement of spring 2 evidences a slight pressure against spring A when the switch is in the middle position, and this is what is wanted. The movement, however, must be as little as can still be noticed, and if it is appreciably more than this, or if no movement at all can be discerned, re-adjust the spring. Now lower the wheel by raising the switch handle, and observe and adjust spring 3 similarly with respect to spring B. One adjustment affects the other somewhat, and it may be necessary to adjust each alternately two or three times. Pains are essential here, however, as every bit of unnecessary movement reduces the possible space between the contacts when the switch is thrown, increasing the capacity of the switch, and in extreme cases risking the thoroughness of the break. On the other hand, an absence of any movement at all would argue a bad contact between the springs when the switch was in the middle position, even though a contact apparently existed. This sounds difficult, but a satisfactory adjustment is reached very quickly in actual practice.

The switch is now ready for use. Fig. 2 shows the circuit in which it is used. The springs 2 and 3 are connected together and

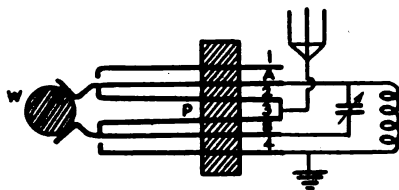


FIG. 2

to the aerial. Spring 4 is connected to the ground. The variable condenser is connected between springs A and B, and the inductance between springs A and 4. Spring 1 is left unconnected. With the switch in the middle position there is a complete circuit from the aerial through springs 2 and A to the inductance and ground, the condenser being short-circuited. With the wheel lowered (handle raised) the circuit through the inductance to the ground is undisturbed, but spring B is forced away from spring 3 and against spring 4, connecting the lower end of the condenser to the ground. As the upper end is connected to the upper end of the inductance, the condenser is now in parallel

(Concluded on page 43)

## Governors'-President's Relay

March 6th, 7th, and 8th.

**I**F ever we had to show what we amateurs can do it is during the Governors'-President's Relay. We must make a strong impression on our President, we must convince him that we are not small boys playing with wireless but real men capable of fighting for our country if he calls us. There must not be a slip-up anywhere along the line and 48 messages must reach President Harding.

Right now we are confronted with the most dangerous situation in amateur radio since the attempt was made to close all amateurs. If we are to overcome that danger we must demonstrate our ability to operate in an orderly manner and with precision during the tests. Stop your other message traffic and stand by for the messages that will come pouring in from every state. Put those messages into the hands of Washington stations at any cost. Don't be afraid to relay a message from Maine to Indiana if that is necessary to get it to Washington. There are some very freakish conditions in the Third District, but don't let them stop our messages.

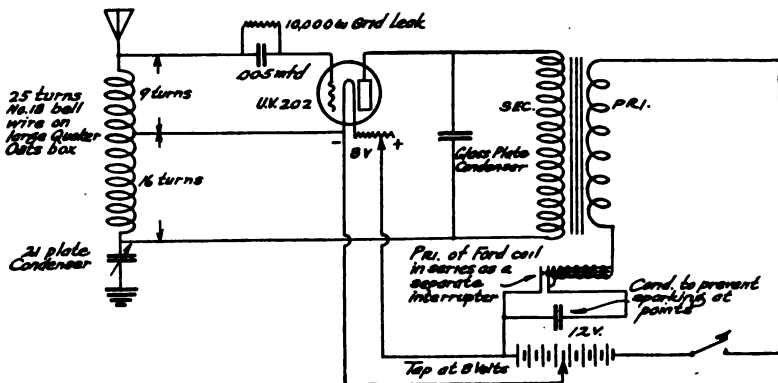
48 messages to the President or whyinell not!

## A Spark Coil-C.W. Transmitter

By Francis L. J. Duffy, 9DDY

**T**HE following description of a little "5 watt" spark coil C.W. set which has been reaching out quite a little distance is tendered in the hope that all of the "gang" who have swamped me with letters asking hook-up and description will see it and profit thereby.

must be of large capacity to prevent sparking in the glass stem of the tube. No fixed capacity can be given but it must be determined by experiment. In my case as I use a one inch coil I used three common spark coil condensers in parallel. The best way, however, is to have it arranged so that



First study the appended circuit diagram. The filament tap is taken off at the 9th helix turn. Using the series condenser a 200 meter wave can be obtained easily. The condenser across the coil secondary

sheets of tinfoil can be added to the condenser at will. An old style Ford coil is used in series with the primary as a separate interrupter, in order to obtain a  
(Concluded on page 48)

# EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



## The 'Phones and Amateur Radio

**A**T our National Convention in Chicago last fall a paper was to have been presented on "The Effect of the Radio Phone on Traffic".

The gentleman who was to have spoken on this subject unfortunately could not attend and the paper was never produced. The title of that undelivered paper, however, strikes the keynote of this editorial—the effect the 'phones, whether amateur or commercial, are having on our amateur work. We have some very serious things to say and we want everybody to read this carefully.

Fellows, do you know the grand old game has changed—that it isn't what it used to be, even a year ago? Time was, before the war and just after we had got on to regenerative receivers, when we could work as often and as long as we liked, and we owned the local air. After the war, with all the publicity radio got, there were many more of us and we had to adopt co-operative schemes whereby the hours were divided so that all got an equal show—like the Chicago Plan and its variations. Once we introduced the idea of team-work and co-operation, tho, we got along splendidly—until the radio telephone came suddenly into prominence this past fall. This prominence of the phone is evidenced in the commercial broadcast services and in amateur broadcasts and in the novice listeners. Within the short space of six months the entire aspect of the amateur world has been tremendously changed, bringing serious problems with it, and we must consider these problems. The whole legislative situation is again in upheaval, and the Secretary of Commerce has just been instructed to appoint another committee of radio experts to devise a new code of radio laws particularly to take into account the new situation brought about by the advent of the phone. Our A.R.R.L. expects to be accorded a voice in the deliberations, representing what the government calls the private radio interests, and your officers want practical suggestions from our affiliated clubs and individual members on the two big matters before us—the regulation of amateur broadcasts and the interference

problem between amateur transmission and commercial broadcast reception. Let us consider them in order.

### The New Broadcast Regulations.

In January, paragraph 57 of the Radio Regulations was amended to require a limited commercial license for all transmitting stations used for broadcasting news, concerts, lectures, and such matter, the wave length for which service is fixed at 360 meters, with 485 meters for crop reports and weather forecasts. The immediate effect of this was the prohibition of all radio phone broadcasts under amateur licenses, with all new licenses stamped with the statement that the station was not licensed for any broadcasting. Our A.R. R.L. has had a committee in Washington investigating this matter and we now have the whole story. Our readers are particularly requested to note the following points:

(1) This prohibition is only *temporary*—the Department of Commerce does not mean to permanently prohibit any useful activity. As quickly as a practical basis can be determined upon, all legitimate services will be restored.

(2) Altho undoubtedly the corporate interests maintaining broadcasting establishments have requested better regulation of amateur phones to protect their own broadcasts, the main actuating motive on the part of the Department of Commerce has been a desire to protect the radio-TELEGRAPH amateur, whom the Department recognizes as the great national asset and whose activities were being fairly swamped by the amateur phones.

(3) Broadcasting is growing tremendously and must be regulated now before it gets out of hand. It should be permitted only when the general radio public is interested, and not merely because an individual to broadcast for his personal amusement or for advertising purposes without regard to the desires of his audience. Nor should amateur phones with rotten modulation, illegal outputs, awful "plate supply noises", and indifferent programs be permitted to broadcast under any circumstances. The right kind of stations will be permitted to continue their service

under a limited commercial license when their activity is desired by the general radio public.

(4) Special authority in all probability will be granted by the Bureau of Navigation to conduct any broadcasts already arranged for previous to the inauguration of the new regulation, and provision will be made for the continued broadcasts of those radio phone stations that are handling market and crop reports, weather forecasts, police alarms, etc., in co-operation with a branch of the Federal Government or their municipalities. In such cases a letter from the Government branch or municipality being served should be submitted, showing that the service is necessary for the public welfare, and we understand the necessary authority will be granted.

(5) The new regulation does not apply to radioTELEGRAPH stations.

(6) The Department of Commerce now needs and wants a new basis for the various amateur activities, one which will give proper protection to all the amateur interests. Suggestions are solicited. It must be borne in mind that this is a big undertaking, probably involving a change in the radio law, and it cannot be accomplished in a day or a week. Everyone's viewpoint must be determined and a fair plan formulated, and then this must be enacted into law before it can be administered. Meanwhile we must be patient in the present situation.

Except for the part that the corporate interests may have played in bringing this about, we are well pleased with it and confident that the concentrated thought now being brought to bear on the matter of regulation will result in an equitable arrangement. Our 200-meter wave length is horribly crowded with the legitimate telegraphic business of an amateur field comprising some 14,000 transmitters, without being burdened with even the best of broadcasts from 200-meter phones. And what chance have the latter of being heard thru the din? And as to the awful stuff that most amateur phones put out from ten-cent records on \$1.89-phonographs with a supply ripple like a thrashing-machine and a wave like the Atlantic—we are glad it is gone and hope it never comes back! Amateur Radio is decidedly the better without it.

We say again, fellows, that the Department of Commerce is our friend. An amateur phone carrying on local conversation during local hours cannot cause much inconvenience, nor can it cause particularly great interference in the amount of traffic it can successfully handle in the later hours. It causes its trouble, then, in its generally ill-guided inclination to "favor" the public with broadcasts, whether the public desire

to be favored or no. The temporary suspending order was issued because it was apparent to the Department that such broadcasts were interfering with stations conducting other kinds of business—the novice listeners to some extent but mainly the other 200-meter activities, the amateur telegraph station. They believe that it is the later who is truly of value, who is most likely to make a real contribution to the art, who is of actual aid to his country in time of need, who can cover distances with speed and perform a worth-while service. And his activities were being hampered to an extent that was getting unbearable and conditions were getting chaotic—the telegraph amateur was being put out of business.

The Department largely looks to our organization, thru its affiliated clubs, to decide by the interchange of ideas just how the amateur radiotelegraph and amateur radiotelephone stations are to be co-ordinated with each other and with the other services involved. It is now necessary to find some way to permit amateur broadcasting where such service is desirable, and still not "gum up the works" for other amateur operation. Some schemes under consideration at present are, first, to allow broadcasting on some other wave length, such as 175 or 225 meters, or, third, to revise the present system completely and institute graded amateur licenses restricting transmitters to waves below 175 for their first year or so, putting all amateur phones on 200 meters, sparks (telegraph of course) on 225, and 275 for C.W. stations using code; and in everybody's mind is the feeling that the commercial broadcasts ought to go to a higher wave length where conflicts with amateur work would be avoided.

Now it's up to us to express ourselves. What do we want? We feel pretty sure that of the two, telegraph and phone, one must be subservient to the other in the new regulations. Our A.R.R.L. is primarily a telegraphing organization and we have always felt that that was the most important thing. It is for us amateurs ourselves to decide the question. We wonder if we have come to the parting of the ways? Do we want to favor the phone to the detriment or possible discarding of the telegraph? We at headquarters don't think so, and feel that "the telegraph's the thing", but we want instructions and suggestions from the gang. What do YOU think about it?

Now, fellows, don't get hot-headed over this thing and join in any loud talk about petitions to Congress to change matters, how the corporations are slipping it all over us and this is the beginning of the end, and so on. This is a thing that has been done largely for our own protection and it has got under control a situation that bid fair to destroy us. And we have been asked to say what we want. So don't start writing



wild protests to your senators and putting on a "blue-card" fight when there are only shadows to fight. If we are dignified and business-like we will gain the consideration of those senators and congressmen when we make our recommendations, and we may need their help in a real blue-card fight some day.

Meanwhile the present regulation is to be obeyed. No more phone broadcasts. And sending out music and addressing it to a particular station while it is yet a broadcast in its intent is just a subterfuge and will not be tolerated. A limited commercial license is necessary for the transmission of such phone matter. Stick within the law.

#### The Broadcast Listener.

And now we come to the second difficulty created by the increased use of the phone—the interference our regular amateur work causes the broadcast listeners. This is a really grave problem and one about which every A.R.R.L. man must think, as it is staring us in the face like a grim spectre.

Here's the story: the big corporations have capitalized all the publicity radio has got since the war, have put up big broadcasting stations which generally transmit entertaining and instructive programs, they advertise this extensively and create an immense demand for apparatus, and then they build and sell the equipment. We all know what the result has been. A year ago the radio industry consisted of a hundred or so firms, struggling along as best they could with what by comparison was a pitifully small amount of trade, counting nickles to make ends meet. Then came the boom! And now they can't keep up. In the east it is practically impossible to buy a receiving set, one has to stand in line to get waited upon only to find that the store hasn't got even the parts one wants, the factories are months behind in their orders altho some of them have tripled their production, and in general the business has taken a boom that was beyond the fondest dreams of a year ago. And it's Mr. Novice who is doing the buying. He doesn't know a thing about radio and he doesn't care as long as he can hear something over it. These men have come in by the hundreds of thousands. We have no doubt they outnumber us amateurs a hundred to one right now, and they are still coming strong. They are buying apparatus by what must be the millions of dollars worth—in other words the broadcasting companies are making "big business" out of what was the game of us amateurs for so many years.

The broadcast listener has been attracted by the phone and so he is undeniably one who has resisted the call of the wireless as we know it—the dots and dashes. He has heard of the A.R.R.L. but doesn't know what it is. He has heard where we have done some wonderful things but doesn't be-

lieve it. He hasn't a ghost of an idea as to how radio works and he doesn't have any interest in finding out. He only wants to know how much it will cost to get a set installed for him, pulling out his checkbook as he asks. He gets a broad-tuning simplified tuner in all probability, and doesn't know how to operate even that. He hears all kinds of disturbances, ships, commercials, amateurs, harmonics, leaky power lines, static. They annoy him, because he has no idea what they mean—knows nothing of the rest of the radio world. He is like a beginner in our own amateur game, only worse because often he is a prominent citizen and used to doing as he pleases in many things. Because, do you know, fellows, these listeners are the mayor, the eminent politician, the bank president, the leading merchant, the doctor, the minister, the president of the board of education—the kind of folks we have long wished under different circumstances to have in amateur radio in order that it might be a truer Citizen Radio. These men are discovering that most of the strange noises that interfere with their concerts are from us amateurs, and what we don't actually make ourselves we are getting blamed for anyway, including static. Directly they are going to get together and say "These amateurs are a damned nuisance—they bust up my concerts. They ought to be kicked out." For you see, men, the novice listener doesn't yet know that there are others besides himself that amount to anything in radio, and at the present time he wants *all the air*, the same as we used to have all of it for *ourselves*. The danger is that these listeners, these prominent men in the community, will call up their senators and congressmen and say "Bill, I want you to do something for me. I've got a wireless and the family likes to listen to these concerts, but we're bothered by a gang of kids all over creation who make the most infernal racket all night long with a bunch of squawks and crashes that knock things to pieces. They're a nuisance—can't you get 'em stopped?" And when all the eminent local politicians and big guns in all the towns get to telling Congress that we're a nuisance, we're likely to get the can whether we are or not. Therein lies the danger.

The trouble is chargeable to many causes. There's the broad tuning of the kind of receivers put out for these folks, their inability to operate anything right, their overbearingness but there's also the too-long and too-broad wave of countless amateur stations, the amateur ether-hog who never stops, the local concert fiends who try to compare with KDKA, the high-handed disdain of the amateur for the novice, the lack of willingness to share the ether with him; and there's the unfortunate fact, beyond the control of either at present, that the amateur wave and the broadcast wave

are much too close together for any hope of entirely successful working.

There will be objection to raising the broadcast wave but it will never be any easier to do than it is right now and it ought to be done now before it gets too difficult. If this were done there no longer would be any conflict between amateurs and concert listeners. There is a band of wave lengths between 1000 and 1800 meters that at present is almost entirely unused, reserved for the Navy. The Navy says that national security demands that they have these waves, but they are not using them. And in time of war *all* waves belong to the military. This is the age of efficient sharing and the trend of the times it to get back on a real peace-time basis and give more thot to domestic matters and less to military. It is our opinion that the official broadcast wave length should be changed to some band in this at present unused range. We believe the situation demands it even now, and it is getting worse, as all the broadcasts can't operate on the very same wave length of 360 meters and their isn't any particular room thereabouts for expansion.

But that may never come about and meanwhile we are faced by our most serious situation of recent years. Do you wonder that we say the game has changed? Up to now we amateurs have had all the air. Now the novices want all of it. Neither of us can have all of it—we must share it, the same as we amateurs did among ourselves when we started the Chicago Plan. We amateurs must start now to correct this situation as it relates to our own activities, and we must get busy immediately to educate the listener to the fact that he isn't alone in his glory and that he too must share. Either that, fellows, or good-nite amateur radio!

Our hope now is in our Affiliated Clubs, and we believe we are going to have a real test of our affiliated strength. Once upon a time our A.R.R.L. consisted of a lot of individual memberships, but since we started the business of local co-operative plans with community tribunals we have become more and more an association of affiliated societies, each representing a community viewpoint rather than an individual one. And it is to our affiliated clubs that we must look for the solution of the amateur-novice problem.

Generally folks are enemies only so long as they don't know each other. To meet is to have their difference dissolve into thin air. The radio club is the forum where we all meet and get our peevs off our chests. Affiliated Clubs, there's a job for you! You must take in to yourselves the broadcast listeners, not only because they're fine fellows when they know you right but to save your necks! Make your meetings in-

teresting for them, and invite them in. They're often the pillars of the community, the type of men you need. Don't let them club by themselves—they need helpful information in the worst sort of way and they're hungry for it—they'll come in if you'll let them. **GO GET THEM!**

Then you'll have a representative organization that can reflect the true desires of the radio population of your community. And then get busy on this interference problem. What are we going to do about it? Why, will you believe it, we have been asked how the A.R.R.L. would regard the proposal to introduce a bill prohibiting amateur transmission of any sort between the hours of 8 and 11 p.m., it being intimated that as the A.R.R.L. was primarily interested in long-distance work which was only possible in the later hours of the night, we might be expected to support such a bill. They're a thousand reasons why we don't want a law like this, but we must do something about the situation or it will happen. How many of us amateurs can get the broadcasts well and how many of us like to listen to them, so that of ourselves alone we would vote for quiet hours? It's a little surprising to find out that a great number of us seem already in favor of quiet hours, and in numerous communities the local amateur clubs have voted for silent air during the broadcasts. If we don't want a national law shoved thru against us we have got to do something quick. That something, as we see it, is to decide the matter in each community by *local option*, after we have got the broadcast listeners in to the clubs so that they will see that we are not a flock of little boys in short trousers but that we are really going after the thing in more serious fashion than they themselves. What you must do, Clubs, is to make yourselves representative bodies, capable of reflecting the spirit of the majority of the radio public in your community, and then actually do the reflecting. Vote on it. In your territory are there only a couple of listeners and a hundred telegraph transmitters who want to do amateur work, and are you far enough away from other broadcast listeners that you won't interfere with them? Then it is plain that you should go ahead and transmit, so that the majority may have their way. But are there as many with only receiving sets as there are real amateurs, and do you discover that most of the amateurs themselves like to receive the broadcasts and desire silent air? Then by all means have the quiet hours—start them at once and make everybody comply with your regulations.

That's co-operation. That's the rule of the majority. That's the only thing that's fair. And it's the only way to keep the broadcast listener from demanding all of the air—and coming close to getting it.

Let's speak a little more definitely. Here is what we want every A.R.R.L. affiliated club to do:

(1) Call a mass meeting of everybody in your territory who is interested in radio—amateurs, broadcast listeners, everybody. Take stock of your local situation and be sure that you get all the broadcast listeners in to the meeting. You *must* have them. Find out who they are and write them letters or better send a committee to invite them to the meeting, and do everything you can to round up everybody interested.

(2) Then talk over these matters fairly and squarely. Tell them that we have a nasty situation to solve and that you want to do it by co-operation. Find out how everybody feels, whether amateur or listener, about both of our big problems—the regulation of amateur phones and the interference between amateur and listener. Give everybody a chance to be heard.

(3) And then start the ball rolling at once in some scheme that will decide whether or not you are to have quiet hours for broadcast listening by the majority sentiment. Take a vote on it and agree to a definite program if at all possible, and broadcast this to everybody in your territory. Try to come to an understanding at that meeting, because it is a hard job to get out a big gang to a meeting. But whatever you do, be sure to get something in the works that will enable the prompt settling of this matter by "local option"—that is the vital thing.

(4) Then write immediately to A.R.R.L. Headquarters at Hartford, Conn., and let us know what you have done. There are two things your Board of Direction wants to know at once: first, is the amateur radio telephone or the telegraph to be favored in the new amateur regulations, and what are your suggestions as to a division of wave lengths; and, second, give us what assurance you can that you have arranged mat-

ters in your territory so that local option, whatever the outcome, will decide the matter of silent air for broadcast hours.

(5) Do all of these things just as promptly as you possibly can.

The general radio public have not yet come to the point where they know anything about what we amateurs have been struggling with for years in the way of QRM—or static. But they want help and that is our chance. At any club meeting not only can every question be answered but friendships can be made which will mean helpful visits from amateurs who know. Gradually they will wake up to the fact that the existing amateur organizations are the very thing they are looking for, and once they are in the clubs they will learn the situation and become a part of us and work with us instead of against us.

We must fight to the last ditch any law sponsored either by the general public or by the big manufacturing interests behind them, which proposes to prohibit amateur transmitting during most of the evening. There is no reason why the broadcast stuff should have it all. Amateur transmission now has it all but we cannot hope to keep it all. What we want is a just and fair distribution of the hours in accordance with the majority sentiment in each community—but we must give consideration to those who want to listen. We must make up our minds that as far as the large centers of population go, the old days of free-for-all amateur radio have gone for good. The day will never return when we can make all the noise we want at any old time of the day or night.

Our A.R.R.L. has a glorious history of real Americanism and team-work in all its doings. Now let's all put a shoulder to the wheel and whip this job. But the minute we break up the team-work—Good-Night!



# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



**A** FEW months ago it was our impression that our message traffic would reach the 25,000 mark and we thought that might be the sky limit, but along comes a bunch of "sky punchers" and over the limit she goes to the tune of 29,941. SOME traffic we'll say! Who is it that says the radio phones will put a crimp in our traffic?

First honors go to the Delta Division again with the new record for handling amateur traffic by 5ZAB.

5ZA—473

9ZJ—310

5ZI—465

1SD—300

There is a list of stations that move traffic and they move it in big chunks. That is why they are way out in front. They are doing the very thing that our A. R. R. L. wants—relaying friendly messages.

Provisions have been made for a new division, the MARITIME Division, which will take in Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland.

## Message Traffic Report By Divisions—JANUARY

| Division     | C.W.  |      |        | SPARK |       |        | TOTAL |       |        |
|--------------|-------|------|--------|-------|-------|--------|-------|-------|--------|
|              | Stns. | Mgs. | M.P.S. | Stns. | Mgs.  | M.P.S. | Stns. | Mgs.  | M.P.S. |
| New Eng.     | 16    | 1157 | 72     | 15    | 1715  | 115    | 31    | 2872  | 92     |
| Atlantic     | 33    | 1377 | 42     | 25    | 1838  | 73     | 58    | 3215  | 55     |
| Roanoke      | 12    | 364  | 30     | 12    | 332   | 28     | 24    | 696   | 29     |
| East Gulf    | 12    | 696  | 58     | 13    | 538   | 41     | 25    | 1234  | 49     |
| Delta        | 3     | 138  | 46     | 13    | 1919  | 148    | 16    | 2057  | 129    |
| West Gulf    | 6     | 969  | 161    | 47    | 3062  | 65     | 53    | 4031  | 74     |
| Midwest      | 15    | 927  | 62     | 29    | 1886  | 65     | 44    | 2813  | 64     |
| Central      | 46    | 1438 | 31     | 84    | 6884  | 82     | 130   | 8322  | 64     |
| Dakota       | 10    | 476  | 48     | 12    | 1088  | 91     | 22    | 1564  | 72     |
| Winnipeg     | 1     | 38   | 38     | —     | —     | —      | 1     | 38    | 38     |
| Northwestern | —     | —    | —      | 12    | 936   | 78     | 12    | 936   | 78     |
| Pacific      | 3     | 20   | 7      | 12    | 2010  | 167    | 15    | 2030  | 129    |
| Ontario      | 2     | 19   | 10     | 3     | 114   | 38     | 5     | 133   | 27     |
| Total        | 159   | 7619 | 48     | 277   | 22322 | 81     | 436   | 29941 | 69     |

Total Spark Messages, 22,322—76%

Total C.W. Messages, 7,619—24%

PULLEN BROTHERS, 5ZAB

Houma, La.

664 Messages

Delta Division

But wait, we haven't told you all by a long shot. Glance over the following list of stations and note the number of messages that were handled by these stations.

9UH—583

2DI—461

90X—575

8FT—442

6VX—528

6ZZ—407

20M—523

8ZAC—374

8AWP—522

5JD—356

5XU—511

5XB—354

K. S. Rogers has been appointed manager of the new division. A change of name from the St. Lawrence Division to the Quebec Division has been made and the Quebec Division will cover the Province of Quebec alone. A. J. Lorimer is manager of this division.

Reports of division activity follow:

### ONTARIO DIVISION

A. H. K. Russell, Mgr.

No report is at hand from District No. 1 this month. but from outside sources the D M hears that there is lots doing in Windsor and Sarnia, but that the main trouble in that vicinity is that the boys there are suffering from inflated wave wengths which

may account for the few times they are heard eastward.

District No. 2 under Gowan is walloping right along though most of the boys stick to the old spark sets. 3PM and 8BA in Brantford have done some fine work, the latter having handled 73 messages. Guelph has formed a radio club but no details are available. 3SU in Galt is beginning to be heard in DX work. 3BI is putting in CW and has a fine receiving range. Galt has a 2 hour silent period every night from 8 to 10. 3KL in Preston is heard now and again. 3QJ reports 22 messages in Kitchener. 3DS is out of business due to deceased bottles caused by trying to make two amperes grow where one grew before.

District No. 3 is strong on transmission but weak on reporting. 3JL reports 19 messages handled on spark, while 9AL has made away with 15 by CW, 9AW 4 messages.

#### ATLANTIC DIVISION

C. H. Stewart, Mgr.

In Western New York there has been relay work of the highest calibre due to the efforts of 8AWP whose signals were reported 150 miles west of Vancouver Island; 8BUM who was reported by 6XAD; 8WO, 8AYT and 8CG. Two new stations have been installed at Elmira. Altho much traffic was handled by New York City stations there were only a few reports sent in. 2DI copped the honors with the greatest number of messages. 2XK handled some messages. A daylight route from New York to Poughkeepsie thru 2XK, 2BJO, and 2DA has been the means of reliable relaying between those points. 2AUU, 2ALG, and 2AJD were the business end of southern New York City traffic.

2FG is back again after a little difficulty. 2PV moves quite a bit of traffic.

The DX men in Northern New Jersey keep the ball rolling and new CW stations are reaching the dead spots which the sparks could not reach. As predicted by the T.M., 2VA is back in the game again and his assistance is welcomed. 2OM is using both spark and CW and, contrary to rumors, the spark has not been junked. CW traffic handlers were 2ACQ, 2AOS, 2AF, 2AQU, 2AXH, 2AOG, 2IA, and 2EJ while the spark stations were 2OM, 2AIM, 2ALY, 2DX, 2ARB, 2BDG, 2AQI, 2BBN, 2VE, and 2SQ. According to reports from Newark and Hoboken everything is "duck soup."

2EL, 2OE, 2AJW, and 2BGR have been knockin' 'em dead with their CW sets and traffic does not hang on their hooks long. 2BSC has purchased the transmitter of 2AID and bumps right along. 2FD is heard but no report from him. 2BRS and 2CY handled some traffic.

8XE has fallen for CW which will be an addition to the spark set. 8BQ continues to reach out very well. 8FZ is the only station in Wilkesbarre that is doing anything. The only other station heard from was 8HR.

Traffic out of Baltimore has shown a decided increase due to the steady operation of several CW stations and the consistent work of 3AHK, 3AC, 3SQ, 3HG, 3EM, 3AJD, 3ZN, and 3UC. 3ZN maintains a schedule with 3ZO. There was no report from District of Columbia, but 3ALN and 3IW have turned to CW. 3ZY holds his pace in traffic. Reports from superintendents and city managers in the Southern Section, especially the above districts, have been coming in too late for forwarding to headquarters. In the future, reports not in the hands of the A.D.M. by the 20th will not be accepted.

Western Pennsylvania has had its troubles with many of the ops going to school and deserting their stations. 8CH and 8PT have taken some traffic for Grove City, Pa. 8BRL cleared 142 messages with spark and CW. Pittsburgh is represented by 8BPL, 8NN, 8OW, 8XH (how about Sunday nights, Wigg?—T. M.), 8BPJ and 8AIO. In Warren we have 8BIL who operates a joint station, at home and at school. 8LX, 8LF, and 8EW of Crafton have had so much other business that required their attention they did not handle many messages.

If those fellows in Philadelphia who are complaining would send in a report, we could report their activity and they would eliminate reasons for complaints. Practically all of the traffic reported was handled by 3FM, 3VW, 3BG, 3HJ, and 3ZO. An error in last month's report is hereby corrected: F. G. Delong is city manager of Reading, Penn. Message traffic for Reading was handled by 3GX, 3LP, 3AUW, 3BJ, and 3AHF. 3AIC is installing a CW set, and the Reading Club is installing a rock crusher. (Funny how this old game goes, one cans the spark for CW and the other sticks to the spark—T. M.)

#### ROANOKE DIVISION

W. T. Gravely, Mgr.

A great improvement in traffic handling thru the division is noticeable. More C.W. stations have been added with the result that there is less QRM and greater distances are being reached. A number of messages have been routed incorrectly which has delayed traffic in some cases. Follow the routes over the short jumps which makes for speedier delivery of messages.

8SP, 8EF and 8AFD did some nice work when they maintained communication for the power company while the lines were be-

ing repaired which came down during the sleet storm. The efforts on the part of these amateurs made it possible for the power company to get back in shape 24 to 48 hours ahead of schedule. Stations QRV for traffic are 8BDB, 8IH, 8AQV, 8AUE, 8BPU, 8ACY, and 8YH. All these stations can be relied upon for quick delivery.

New stations are being installed in Richmond and Petersburg to assist 3MO and 3TJ, which stations have moved some messages. Practically all of the stations in this section have given up their radio for some reason or another. There is not the old active crowd that we used to have on the air every night since most of the real DXers have quit the game. 3ZZ seems to be the only one who is on most every night. 3ACE is doing some work but little traffic handling. 3MK and 3BLG are heard once in a while. DF-1 is the leader in this section but no report has been received.

Southwest Virginia continues to move its traffic without much difficulty through 3ZX, 3ZAB, 3RF, 3CA, 3BIY, 3BHS, 3AAL, 3BKX, 3BNM, 3HL, 3AOV, and the twins, 3BZ and 3AEV. Many new stations are reported in and around Danville. In general, conditions have shown a great improvement in this section and such improvement will continue.

In the North Carolina District a fair amount of traffic was handled without any delay. Kramer and Bunker have resigned and other names will be announced next month to fill the offices of District Superintendents. 4EY has closed down for the season, a good station that will be missed very much. 4EA was the leader in this district with 87 messages to his credit. 4BX, spark; 4XD, C.W.; 4CQ, spark; 4CX, spark; 4GN, spark; and 4EN, C.W. did much toward boosting the total messages for the division. 4ID is a new C.W. station as is 4DC. 4DQ uses both spark and C.W. 4CK jumped off the brink of single blessedness. (Congratulations OM, and we hope she will permit radio.—T.M.)

#### EAST GULF DIVISION B. W. Benning, Mgr.

During the Christmas holidays the operators from 5XA scattered out over the state and tried to see what they could do towards getting some of the other stations in the state to working. Their efforts are beginning to bear fruit.

H. S. Brownell of Birmingham visited all the stations he could locate there to see what the possibilities were for a real DX station. The immediate possibilities were very discouraging, there being only one station with much chance of "getting out" right away. That was 5GI. Mr. Brownell got right down to work helping to readjust

the apparatus of this station, tuning him properly with a wavemeter from 5XA, and results were almost immediate. 5GI has successfully worked 5XA, 5YI and 4GU and has received numerous cards reporting his signals heard elsewhere. 5UI at Montgomery was properly tuned, but due to lack of time other very necessary improvements could not be made. 5AR at Bay Minette has plenty of good spark transmitting apparatus but nothing with which to receive amateurs properly. 5ON at Anniston hears a number of amateurs, but so far has been unable to get a condenser to hold long enough to enable him to do any work. 5XA has been doing practically all of the work, even tho having much condenser trouble. We have at least managed to keep one of our numerous transmitting sets in operation all the time.

FLORIDA: Supt. Harrod states that he has been up against it on account of the failure of City Managers, etc., to send in any report. In fact, City Manager Clark of Jacksonville was the only man to send in a report. Fellows, we MUST have better co-operation. Take your calendars and mark the due date of your report with a great big mark, and when that date comes around sit down AND MAKE UP YOUR REPORT AND SEND IT IN! Without your help the old East Gulf Division will never attain the goal for which we are so earnestly striving.



ONE REASON WHY BUX'S  
OUTPUT OF CARTOONS HAS  
DROPPED OFF 50 % LATELY

In spite of the lack of proper reports, however, Supt. Howard states that Florida has taken a decided forward step during the month. Jacksonville handled 44 messages, these being equally divided between 4ZE, CW, and 4DK, spark. 4FS is working on a 20-watt CW set. 4BP and 4EZ have been busy building new radio "shacks," 4EZ will soon be on the air again, 4AH is trying out a 1 KW, and 4CI has a ½ KW spark. In Orlando, the habitat of our District Supt., the Electrical Society has taken

a great interest in radio, and preparations are being made to make Orlando a leading center of radio activity. In St. Petersburg stations 4JY and 4IW are now complete, and they will greatly assist in handling Florida traffic. 4DZ and 4BC, of West Palm Beach, spark stations, are doing DX work regularly, 4DZ being in direct communication with 4II.

**NORTH GEORGIA DISTRICT:** 4BQ's CW signals have been reported as far west as Gray Bull, Wyoming. A counterpoise has been installed and the radiation of both spark and CW sets very materially increased. Several first class receiving sets have been installed in and near Rome, 4BQ is preparing to add a chopper to his CW set to make it easier for him to raise DX stations. He reports no trouble working them once he gets them, but a good deal of trouble making the first connection. In Atlanta 4AU handled 32 messages, and 4CG 15 messages. 4XC romped in ahead with a record of 52 messages. 24 messages were handled by various other stations. 4HW has been heard in southern Florida on his 10 watt phone set. Several stations have been working with 2FP quite frequently, and the ether between Atlanta and Florida points is constantly agitated by passing traffic. The Atlanta bunch is getting down to business and have determined to handle 500 messages by next report time. Their motto is "We can if we will," We'll watch 'em!

**MIDDLE GEORGIA DISTRICT:** 4DH of LaGrange shows he is right on the job by handling 30 messages. He is installing a CW set. Macon, Ga., where our Dist. Supt. gives 'em official instructions when putting up power lines to avoid interference with radio stations! 4AS has sold his 1 KW spark thunder-bus and installed a 10 watt CW set. 4GU has sold his ½ KW QR-Emmer and gone from bad to worse by replacing it with a 1 KW coffin. Messages handled by 4BK total 60. The D. S. suffered from temporary aberration a while back and sold his radio set. The shock cured him however, and he bought the blamed thing back at about half as much again as he sold it for. Once bitten by the "Bug" there is no cure! Midville, Ga., here's where we have two real good stations of the spark type. 4GN has been appointed City Manager. This station handled 135 messages, which is a mighty good showing, nearly half of these being handled with 5XA. 4GN states that it is still difficult to work Florida stations but traffic was handled with 4BC, 4DZ and 4ZC. 4FD handled 9 messages, five of these being spark and four CW. We cannot hold this record against him, however, as he has been experimenting with a little 5 watt CW set—as a starter and succeeded in working 4GH, 4GX, 4CO, 4FR

and 5XA, after which he "shot" the filament of his tube.

**SOUTH GEORGIA DISTRICT:** There are four CW stations in Savannah which can work simultaneously WITHOUT any local QRM whatsoever, 4GL, 4BY, 4EL and ? The South Georgia District has only three stations at present capable of, and doing real DX work. But, fellows, those three sure DO the work! Conditions as to connections with other Districts and states unchanged. Mr. Dooley and Prof. Funk have their new high power CW set working with 4 amperes radiation, and Ship Owners' have installed a DeForest telephone. Both are awaiting call assignments to begin operating. For the first time in many years 4AG has had to almost entirely abandon his pet hobby, in consequence of which 4AG has created very little QRM since August. A 20 watt CW set is a possibility at 4AG, and should this materialize SOME of these boasting stations had better close the muffler cutout and put the clamps on tighter on the old headset.

#### NEW ENGLAND DIVISION

G. R. Entwistle, Mgr.

Glad to be able to report a general reduction in wave length in this district. Most of the DX men are on 200 meters or below with no apparent lessening of distance. Every official relay station must be on 200 meters or lose his appointment.

Radio Inspector C. C. Kolster and Assistant Radio Inspector, Walter Butterworth have been active recently in the enforcement of wave length requirements with the results mentioned above.

1SD (spk) cops the tin wreath this month with 300 msgs. Closely following him are: 1DY (spk) 292; 1BVB (spk) 280; and 1TS (CW) 233. 1BJE and 1ASF (both spk) helped boost the average with 200 each. In addition, five of the "Old Guard" have reports in three figures: 1AEV (CW) 172; 1RV (Spk) 155; 1ZE (CW) 154; 1BRQ (CW) 121 and 1ANQ (CW) 119.

A. D. M. Mix (1TS) reports a complete re-organization in his section. Twenty-one new appointment certificates have been sent out to date and the working out of new schedules is progressing rapidly.

The station of the Worcester County Radio Association, 1BKQ, has been working DX in great shape, using two 5-watt tubes. It has been reported moderately QSA at Columbia, Mo., and has worked seventeen states and Canada.

Robinson (1CK) reports increased activity in his section with eleven stations reporting a total of 1384 msgs. 1BJE reports a good daylight route to New York via 1AZW (CW) at Newport, R. I. A.D.S., Randall (1ANQ) reports an increase over last month in msgs. handled.

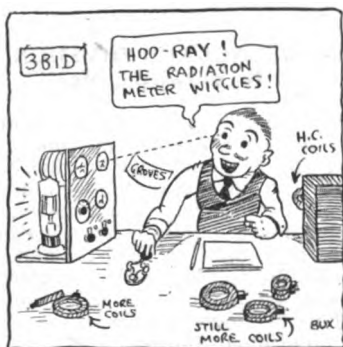


### DELTA DIVISION

Hubert E. deBen, Acting Mgr.

The past month has been a booming one for relay work in this division. More messages were handled and more stations interested than ever before. Willing and ready co-operation, on the part of each and every one, both in spirit and in actual work, made this month the most successful seen so far. In this connection special mention is due 5ZL and 5ZAB—these stations handled over half of the total traffic.

ARKANSAS: A. W. Kinsolving, Supt. reports improved conditions prevailing throughout the district. 5MA of Arkadelphia is now handling traffic with his new 100 watt CW fone set. 5RO is also now in the traffic handling biz. 5UE, Conway, has a  $\frac{1}{2}$  KW and Amrad quenched and is reaching out in fine shape. R. L. Pemberton has been appointed C.M. of Scotts and contemplates the installation of a 500



cycle set as soon as he sells some more Airedale pups. (A little ad in QST ought to do the trick—DS). 5SP of England will soon open up with a 1 KW and CW set. Dr. L. M. Hunter, 5SM, was elected and appointed C.M. of Little Rock at a recent meeting of the ARRL men of that place. Doc Hunter will have his hands full doctoring up traffic conditions out that way. 5JD is doing remarkable work. 5ZL showed his usual superior form—465 was his lot for the month.

LOUISIANA: W. L. Barrow, Supt. reports steadily improving conditions. 5ZAB, manned by the Pullen Klan, keeps things humming out Louisiana way and easily outworked the rest of the division by a large majority. Their splendid work cannot be too highly appreciated. 5LA has been appointed C.M. of New Orleans. Mr. Manard is a youth of high ideals and exceptional ability. 5KC, Plaquemine, La., is stepping out and gives a very good account of himself. 5ZAC is operating on a temporary aerial with 10 watts CW. Baton Rouge is back on the map in red letters

with a  $\frac{1}{4}$  KW and 1 KW sparkers and a 10 watt CW set.

MISSISSIPPI: W. L. Kennon, Supt. reports 5YE still out of operation due to extensive remodeling in progress.

TENNESSEE: Supt. Hutcheson informs us that conditions continue to show improvement in his district. Knoxville is showing considerable activity and the ether is beginning to boom. 5XK until recently has been the only station able to do DX work, but during the month 5UU, 5LF and 5PY succeeded in getting their transmitters in operation and are now doing fine work. S. W. Wilkinson has been appointed City Manager of Knoxville. He has put into effect rules and regulations for the purpose of minimizing interference and improving general operating conditions. Mr. Wilkinson is at present operating station 5UU and handling considerable traffic. 5ER reports very little traffic handled during the month. 5MB's transmitter was out all of the month. 5EK says that considerable activity is being shown around Memphis. Memphis has now a new club and several of the members are installing CW sets. 5DA with characteristic modesty, fails to mention his station; however his good work stands out too far to be overlooked and we sincerely wish to commend him.

### MIDWEST DIVISION

L. A. Benson, Mgr.

The next issue will contain a complete list of new officers together with full details relative to the re-organized Midwest Division.

MISSOURI, 9ZAD, Supt. 9EX reports that most of the traffic thru St. Joseph is being handled by C.W. in the early morning. He has written 15 or 20 stns. that are heard in daylight and would form reliable routes from Iowa to Oklahoma and from Illinois to Colorado. 9EX at present is using a 100 watt tube set. Traffic thru K.C. is being handled mostly on C.W. by 9AQR, 9ASD, and 9AVN. 9DZI and 9AOJ of Columbia are working early mornings. 9BNO is reaching out well with his fone. Msgs. are being handled by fone entirely between 9BNO and 5MA. 9MA and 9DAZ of Jefferson City will be ready for any traffic thru central Missouri. Two good daylight routes are in operation between Columbia and Kansas City, one thru 9SJ and the other thru 9BMN of Sedalia and 9AVK of Holden.

IOWA, 9JA, Supt. Bloomer reports for southern Iowa all routes working in good shape. 9JN is installing CW but lately has been handling a great deal of traffic by spark. 9AMU proves to be coming thru with his C.W. 9YAE is burning up the air in the wee hours of the morn. He forms a dependable link in the northern route.

Other stns. doing good work are 9ARZ of Clear Lake, 9DOF of Hampton and 9AXU at Boone. Breene of 9JL reports an increase in traffic. 9BAP at Waterloo with a ten watt set is working twos and threes every nite. 9CS of Clinton is on the job regularly. Cedar Rapids has three live stns., 9AVE, 9DVO and 9SG. At Davenport the honors are about divided between 9MS, 9AWX and 9UG. 9OZ and 9PL at Ottumwa with the help of 9ABY and 9SL make the southern route complete. 9YO has four operators and maintain a watch until midnight. At Des Moines we have three stations that are putting the state on the map—9IY, 9DEH, and 9OA.

NEBRASKA: 9HT, Supt.—9VE of Omaha is still working his ten watt set and obtaining great results. 9DUP of Wahoo is doing good work on C.W. and has been reported QSA at a distance of 850 miles. Mr. Harvey of David City, Nebr., reports traffic moving thru his section in great style. Several sevens have been worked consistently and traffic west can be cleared thru 9AMB and 9DTM. A great deal of traffic south and west is cleared thru the old standby, 5ZA. 9AIF clears most of the South Dakota traffic while 9DNC is handling a great deal on C.W. 9EW has also been handling traffic on C.W. and is working rings around many spark stns. in his vicinity. 9WI of York deserves great credit for his constructive work in the forming of routes and the handling of traffic. All stns. in the state of Nebraska should communicate immediately with J. G. O'Rourke, 6406 Maple Ave., Omaha, and obtain a quantity of station report blanks.

#### WEST GULF DIVISION

Frank M. Corlett, Mgr.

All Asst. Div. Managers have reported on time, made excellent reports and covered the ground so thoroughly that there is nothing left to be said by the Division Manager except to express my appreciation for the good work. Fine work, fellows, let's keep it up.

#### SOUTH TEXAS SECTION

District Supt. Nettleton of Eagle Pass reports traffic moving nicely in all directions except west, and that condition being due to congestion of the few available relays west of his section. 5ZAK continues to be the busiest station in west Texas. 5ZAN comes second, and as Asst. Supt. is energetically building interest in his vicinity. Altho 5ZAE at San Antonio has been constantly handicapped, he has broken thru and his sigs are reaching to Houston. 5ZR is again in the air after an extended absence.

District Supt. Tilley at Austin briefly states that his district is very much on the map with reliable short relays in every

direction in operation; representative stations being 5KP at Elgin with C.W. and spark; Rockdale with 5NH and 5PR; New Braunfels 5YK; Victoria 5TG. Altho Texas University station is still rebuilding, it continues to be the best station in the district. 5ZU is constantly receiving splendid reports on his C.W. from points as far east as Pittsburgh, Pa.

Altho new stations are opening up constantly in the Houston district and the usual number rebuilding, some of the old faithfuls are always on the job to keep things moving, being especially true of our star station 5XB. 5MX is a new station in the northern portion of this district and located at a point badly needed. 5QJ has been of value to this section in opening up a relay north. Asst. Dist. Supt. Hatry reports that traffic is tied up thru breakdown of 5KN. Galveston is now well represented with 5TT, 5CQ and 5VY who take turns in keeping a good long watch. That's the stuff, fellows!

#### NORTH TEXAS SECTION

District Supt. 5XJ, reports the North Central District gaining and many new stations are being installed in places that will help open up short jump routes, still there are many places such as Baird, Cisco, Albany, Mineral Wells and Eastland that need good C.W. or spark sets that will reach out and help traffic. The D.S. would like to hear from some one in the following places: Gatesville, Balanger, Coleman and Quanah. The Dublin territory is still hammering away with DX and again leads in messages handled, 5XJ being their star, and 5IR handling a few by voice. 5QS has been putting his small C.W. set through, working an eight on 5 watts. 5QT is reaching out. 5AO is back in the ring. 5RP is still using a spark coil.

5NY at Abilene is doing some good work handling traffic west. 5VB and 5VE are constructing a one-half and a 1 KW respectively which will help 5NY with traffic going west.

Currie Cladwell, D.S. Northeast Texas District, reports his district moving off in first class shape. 5ZAM, Commerce Territory A.D.S., reports a decreased handling of messages in that territory, and would like to hear from all amateurs in the following counties: Fannin, Hunt, Lamar, Delta, Hopkins, Rains, Wood, Franklin, Red River, Titus, Upshur, Morris, Bowie, Cass, Marion, Harrison and Gregg. Frank Cane, 5IS, Greenville is doing some fine work with his one-half KW and is also using C.W. 5TH at Paris with his spark is handling a great deal of traffic. 5ZAF, Waco Territory A.D.S. reports traffic speeding up through his territory. Despite the fact that 5ZAF's transmitter has been undergoing a few slight changes he is the star station. Mr. Clark would like to hear from

all amateurs in the following countries: Johnson, Ellis, Hill, McLennan and Bell, 5PJ, City Manager of Ft. Worth reports a marked increase in number of messages handled. Other activities missing from his report.

5IF Dist. Supt. Northwest Texas does not report much activity. C. A. Akers of Happy, Texas, is trying to get in shape to do relay work; he is limited to power input there being no electric plant in his city. 5IF would like to have the names, call letters and description of each amateur station in his territory which includes the following counties: Andrews, Martin, Howard, Mitchel, Coke, Nolan, Fisher, Stone-wall, King, Gottle, and all stations north and west respectively, to the state line.

#### NEW MEXICO SECTION

The new station of the University of New Mexico at Albuquerque has been heard in the air and sounds like business. The installation consists of a 2 KW sink set. Call is 5YO. Another new station, 5AW at El Paso, Tex., has made communication with El Paso possible. For a long time traffic for that city has been going thru Las Cruces, a connection with El Paso being impossible. 5AW uses a 10 watt C.W. and it surely shows how efficient C.W. is as compared with spark. 5ZA is working mostly with C. W. and I.C.W. now.

#### OKLAHOMA SECTION

5BY and 5LB are going again now and are to be heard most any nite. We are glad to note that 5BY is getting out, for we have long needed a good station at Lawton. 5JR of Enid and 5ZZ of Blackwell are heard regularly. 5FO is going strong as ever. 5HK of Oklahoma City is on the job every nite and handles a large portion of the Oklahoma Traffic. No report from 5LO, 5QH, 5PU and others of that section. 5EF of McAlester is selling his spark set and will be using CW. 5OO and 5AN, also of McAlester, are still at their posts. 5AN is working with a 5 watt fone set. 5BM of Muskogee is troubled with QRM from high tension power lines but manages to work some when it is not so bad. Too bad, OM. 5TJ is still working with his 20 watt fone. The greater portion of Oklahoma traffic is being handled by 5FO, 5HK, and 5ZZ.

#### CENTRAL DIVISION

R. H. C. Mathews, Mgr.

MIAMI VALLEY DISTRICT OF OHIO: Quite a few stations were out of commission the entire month and a few others failed to report this month. A tendency is noticed among the stations not to report their messages unless they have a fairly large number to report. The District Supt. would like to announce that it is just as important

to report the few messages as the large numbers and even more so, because no report brings no credit, while a small report gets whatever credit is due. All stations seem to be doing excellent work and the City Managers are hoping some day to get their relayers educated to keep accurate records of the traffic handled.

Although the number of C.W. stations are on the increase the number of C.W. messages reported is less than last month but the number of spark messages is also far below last month's. This decrease is no doubt due to the fact that several of our best stations were out of commission during a part or all of the month while others failed to send in their reports. No reports received from Dayton, Xenia, or Sidney, and from only two of the Cincinnati and one of the Springfield stations.

DISTRICT OF ILLINOIS: A.D.S. Burke, 9NQ, has little to say about conditions around Galesburg. 9CA, Dwight, Ill., is the keystone in the route to Chicago from southern Illinois and reports that new ones are springing up every day. 9APG in Cazenovia is coming to life and getting out on the air. Champaign now boasts of a real O.W. in Miss Helen Long who has become ensnared by the pastime and is delving into the deeper mysteries of oscillators and regenerators, having deserted the feminine realm of the order of "hair-pin". A.D.S. Smith, reports 9DDY spark-coil-C.W. station rapidly building up records with one 5-watt tube, and reports a reliable route to Chicago day or night via 9CA, Dwight, to 9UU or 9DBZ. 9CA has been appointed concentration point for all Chicago-bound messages. 9JV reports things as usual in his vicinity.

NORTHERN INDIANA: The tube set of 9II is getting out in great shape. F. S. Libbee, South Bend, reports activity on the increase and several tube sets being installed. The fellows there are trying to minimize QRM by installing C.W. sets. Mr. Libbee formed schedules with 9XI west and 9AIO, 8BOX and 8BK east. L. B. Wilcox reports a fine branch line established from Detroit to Fort Wayne via 8BXA (Lansing), 8YN (Battle Creek), 9DF (Angola), and 9II (Fort Wayne).

KENTUCKY DISTRICT: 9UH reports that his territory is going strong. It is gratifying to learn that the dead spot between Louisville and Newport has been overcome by 9YC.

DISTRICT OF WISCONSIN: 9TO reports several good operators at Thineland and Mattoon but ND on transmitters. 9YAC claims that the weather was so poor the past month that DX work was very erratic. The nearest stations they work are at St. Paul and Baudette, both around 150 miles. 9QS of Superior is installing 9PN's sink gap.

9GP misses the traffic from the north and west and claims that there is no where near the amount there was last season (9ZL's fault). 9AXA has been doing excellent work and is in a position to handle traffic for all points east and west, particularly fine for Madison. 9ACM claims that the fellows of Sheboygan are asleep on the job. There are a number of good stations there but they do not seem to take any interest in relay work. 9DHG, has also been doing excellent work. His station appears to be about the only DX station in his city. R. O. Hartin, City Manager of Kenosha, has been forced to resign because of the fact that he is moving from Kenosha. Mr. Junior Vincent will handle this position in the future.

**TOLEDO DISTRICT OF OHIO:** 8ZN complains of the lack of co-operation from the stations. It seems that after one of the smaller stations work a long distance station, they would rather spend the night calling DX in vain hope of sending their traffic over the greatest jump, and do not try to get their traffic off as quickly as possible by utilizing the stations who want the traffic and who can handle it, even if by short jumps. 8BEP has got in the relay game in earnest. This station is QRK over a wide range, and is well equipped. 8ZY is back in again, though rather on and off as he is making changes to put station in maximum efficiency. 8AQZ at Loudonville has been handling his share of traffic with a fine C.W. set. He maintains a regular schedule with the east.

8IZ has been able to locate no more than a galena detector station in Port Clinton and the other towns he was appointed to cover, excepting in Sandusky the well known C.W., 8BOZ, who as near as can be found out is doing excellent work on 20 watts.

9ACW, Traffic Manager Waukegan and North Chicago, reports that he is now on every Friday and Saturday night, with ½ k.w. spark set. 9AVP was on for about two weeks this month with ½ k.w. spark set in Waukegan. 9UY on most any night, ½ k.w. spark set in Waukegan. 9OF, Waukegan, on with ½ k.w. set that does not seem to reach out as the first three do. 9BBR, North Chicago, on with five watt C.W. set.

Prof. Achatz reports 9YB of Lafayette, Ind., now has power until midnight on Mondays, Wednesdays and Fridays and occasionally on other nights.

City Mgr. of Akron reports no trouble in relaying traffic from Kansas and Nebraska directly to the Atlantic coast. No spark station of much activity in operation in Akron at present. C.W. in favor about 3-1 at present. Local QRM is under control through the co-operation of the Executive

Radio Council of Akron and the respective radio clubs.

#### DAKOTA DIVISION Boyd Phelps, Mgr.

Traffic is moving in great shape and club activities are the liveliest ever seen. More C.W. stations are opening up in the small towns which should mean short jump relaying next summer. The difficulty now is that there is comparatively little working between spark and C.W. stations resulting in a decrease in the speed of relaying where stations are scarcer.

9ZC, of Baudette, Minn., reports more new stations in his District, notably 9DHG of Cloquet and 9BAF of Brainerd who are clearing traffic for their vicinity. According to 9EA, City Mgr. of Duluth, there were last month five times as many msgs. handed out of Duluth on C.W. as were handled on spark, 9EA and 9AEZ leading with promise of good competition from 9ADF and 9CO.

9YAJ, of St. Olaf College, Northfield, Minn., has been very active in his District. 9BBF of New Ulm has been doing great DX on one 50-watter in daylight or night. 9YAJ does good work on spark and has recently added two 100 foot steel masts, a fan aerial, and a counterpoise. In the Twin Cities 9XI, 9HM, and others by spurts handle traffic. J. F. Carpenter of 9XI has been appointed City Mgr. of Minneapolis and with the aid of J. A. Hall, City Mgr. of St. Paul, and the Twin City Radio Club, the Twin Cities have been divided into districts for closer supervision of traffic and tuning.

Stations in western North Dakota are still missing. 9WU-9ZX, District Supt., and 9EE-9ZX have been our reliable links to North Dakota and the west. This makes Ellendale the distributing point for msgs. to this territory. 9AGN and 9DOC have strong sigs but special mention this month is due 9FX at Jamestown and 9LW at Wahpeton for their constant and persistent relay work.

The good effects of a state convention are already being felt in South Dakota according to N. H. Jensen, Box 894, Sioux Falls. This has brought in many queries concerning the League from those new in the game. Such meetings do more for radio than 'most anything else. C.W. is slowly but surely coming to the prairie of South Dakota.

#### ALASKAN DIVISION Roy Anderson, Mgr.

7IP, our first real Alaska station, failed to send in a report. The operator on the U.S.L.H.T. Cedar heard 6AK, 9YAK, 9WU, 9AAU, 7YL, 7XJ, 7XY, 9XAQ, 9AMO, 7CE, 6ZR, and 9DTM, showing that it is

possible for us to hear stations in the States.

We have 9 members in this division, but we intend to stick together until such time as we can establish real communication for Alaska.

### PACIFIC DIVISION

J. V. Wise, Mgr.

This division has been divided into districts which are given herewith. District "A" includes the entire State of Arizona, with H. L. Gooding, 6ZZ, of Douglas, Ariz., in charge as District Superintendent.

J. F. Gray, 6MZ, of Del Mar, Calif. is District Supt. of district "B" which includes the counties of San Diego, Orange, San Bernadino, Imperial, and Riverside, Calif.

"C" includes the California counties of Los Angeles, Gern, Ventura, Santa Barbara, San Loui Obispo, Kings, and Tulare. B. H. Dennis, 6ZN, of San Fernando, Calif. is District Supt.

District "D" takes in the counties of Fresno, Inyo, Mono, Madera, Mariposa, Tuolumne, and Alpine. The office of District Supt. is vacant at this writing.

District "E" includes the counties of San Mateo, Santa Cruz, Santa Clara, Stanislaus, Merced, San Benito, and Monterey. No appointment has been made for this district.

District "F", San Francisco, Marine, Mendocina, and Sonoma. District Supt. will be announced later.

"G", Alameda, Napa, Solano, and Contra Costa. No appointment.

"H", Sacramento, San Joaquin, Sutter, Eldorado, Placer, Yolo, Sierra, Nevada, Yuba, Calveras, and Amador. No appointment.

"I", Del Norte, Humboldt, Siskiyou, Trinity, Glenn, Lake, Colusa, Shasta,



Tehama, Modoc, Lassen, Plumas, and Butte. No appointment.

"J" includes the entire State of Nevada with G. M. Lewis, 6QR, of Reno, Nev., as District Superintendent.

Pacific Division amateurs are requested to note in which district they are located and to get in touch with their superintendents immediately, informing him of the number of messages handled during the month, whether spark or C.W., and any other activity that is of interest to the amateur fraternity.

District A—Last month has been one of heavy QRN with very few nights for DX traffic work. 6AAH is handling all traffic for Phoenix. 6TV is now in Tucson doing good work. 6ZZ continues to move all east bound traffic thru QRN. Yuma will be represented by 6ZAK which will open another route east from California.

District B—Stations heard nightly moving traffic are 6KC, 6ZB, 6AKL, and 6AEH. However, no report was received from 6MZ.

District C—6AIF has taken practically everything from 5ZA for two months. 6JD, 6KA, and 6AIF operate both spark and C.W. Traffic is continually on the move through the fine work of 6OD, 6LC, 6MH, and 6ZN.

District D—6ALE has been the only station heard from in this district and he has been on the job with his 250 watt C.W. set. More information is wanted from the amateurs in this district.

District E, F, G, H, I.—Our traffic report is taken from these districts for this month. San Francisco Bay traffic is handled easily by 6AS, 6AH, 6TU, 6VX, 6EX, 6XH, 6HC, and others. 6ZK is back again with the old coal burner which is second to none. (Come on, 6ZK, let some ship use it for an anchor and stick in C.W. We at 1AW have been listening for your sigs—but nil. A new hat that C.W. will put them over.—T.M.) In Central California the old gang is back after sticking up the poles that heavy southeaster took down.

District J—6AJR at Reno has installed a kilowatt spark and will be a big help to 6QR in moving traffic east or west over the central route. 6ZO peddled the spark and is using 10 watts of C.W. in keeping the traffic off his hook. 6UO has both spark and C.W. Traffic for the east via 6QR and 6ZAM is rather uncertain. From Reno via 7LY, 7OT, 7LU and 6ZZ it moves consistently. 6ANK is using 10 watts of C.W. after having junked the spark.

### NORTHWESTERN DIVISION

H. F. Mason, Mgr.

Traffic in the Eastern Section has been heavy and it has been moving more consistently than in the past because QRN has been nil. 7ZU was the busiest traffic station. A CW set is being installed that will help the old spark. 7XB continues to reach the DX traffic for Montana. 7LY and 7VZ did their share this month.

Stations handling traffic in and out of Portland are 7BB, 7BJ, 7BR, 7GJ, 7JW, 7ZT, and 7ZJ. CW sets are being installed at 7JW and 7ZB. 7ZJ has a regular daylight schedule with 7YS which proves a good means of moving traffic. Communication has been established with 9WU, 9YAK, 9AYE, and 5XU, a distance of 1800 miles.

(Chalk down another one for the sparks, OM.) 7ED is back again after a long time out. 7ED was the official delegate at the Pacific Coast Conference, having been sent by the Northwestern Radio Association.

7PO, 7IY, and 7BK have been taking all traffic for Seattle and more messages were handled than ever before, probably on account of the Xmas rush. (Do your message rushing early—T.M.)

Messages have been ground out in Tacoma by 7BA, 7BC, and 7CE. We know it because we heard them but they sent no report.

The success of the handling of traffic in the eastern part of the state is due to the consistency of 7FI, 7NL, 7ZS, and 7GE who are pushing 'em along in fine shape.

There are many vacancies that we want filled by good live amateurs who are full of pep and who will co-operate in a way that will put this division out in front.

### WINNIPEG DIVISION

Boyd Phelps, Acting Mgr.

The best station in Saskatchewan by far is that of Mr. Jack E. Maynard, 4CB, District Superintendent at Morse, Sask. 4CB uses up to 15 watts of CW and has worked 7ZJ, 7ZT, and Canadian 9BD on the Pacific Coast, also more than 40 U.S. stations including five in Denver. Regular schedules are maintained with 9AIG so U.S. traffic may be routed thru this station. 4AO, Moose Jaw, has been getting to 4CB on a straight gap. 4BR, Geo. Shadick of Regina, is working on his 30 watt CW set as is 4BV, Paul Socolofsky, of Loreburn. 4CB is having lots of trouble raising spark stations west to handle traffic and not locating any CW. Who can help?

4BG has been working 9AGN every day so this traffic route is at all times open to Winnipeg. A movement is now on foot to get thru a Trans-Canadian test and route but possibly we may have to ask for assistance of one American station to span the space from Ontario to Manitoba.



The fellow with a 300 meter wave

### A SPARKCOIL C.W. TRANSMITTER

(Concluded from page 28)

500-cycle tone. While this lowers the radiation a trifle it makes it much easier to raise 'em.

I did not obtain any results at all with a three terminal Ford coil (when one terminal of the secondary and one of the primary are connected to the same tap) at least when the same battery is used for filament and high voltage. A regular four-terminal one-inch spark coil was used instead.

As to the radiation: on 200 meters a little over 0.5 amp. is obtained, while it is about 1 amp. on 300. I am at present using a 4-wire counterpoise 15 feet from the ground but this did not help the radiation a great deal.

And as to the results obtained: I was reported QRK by 9NX, Wichita, Kansas, a little over 550 miles, and have worked 9BBF, New Ulm, Minn., over 400 miles. Also worked 8BOX who reported me QSA and heard several times. Also worked 9MC, broad daylight, a distance of 160 miles, who reported me fairly QSA. Beside these, over 70 locals have been worked and I seem to raise anyone within 100 miles in daylight, about as well as a ½ K.W.

I think this is a solution to the spark coil ham, for this set costs very little (in my case about \$10) and the advantages are obvious.

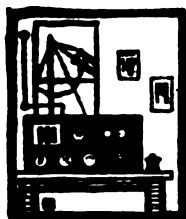
I will say in conclusion that if anyone desires further information on the above I will be glad to accommodate and would be more than pleased to have a card from anyone who hears me.

### AN IMPROVED PRIMARY CONDENSER SWITCH

(Concluded from page 27)

connection. With the wheel raised (handle lowered) spring A is forced away from spring 2, breaking the direct circuit from the aerial to the inductance, and forcing the energy through the condenser on its way to inductance and ground. This gives a series connection, with the condenser in the aerial lead. Should it be desired to place the condenser in the ground lead at any time it is simply necessary to reverse the aerial and ground leads, reversing the inductance leads at the same time if for any reason it is desired to keep the polarity of this latter unchanged. This operation will not affect the parallel or plain connections in any way.

This switch has been used successfully by the writer, and has commended itself to him by its simplicity in operation and economy of space.



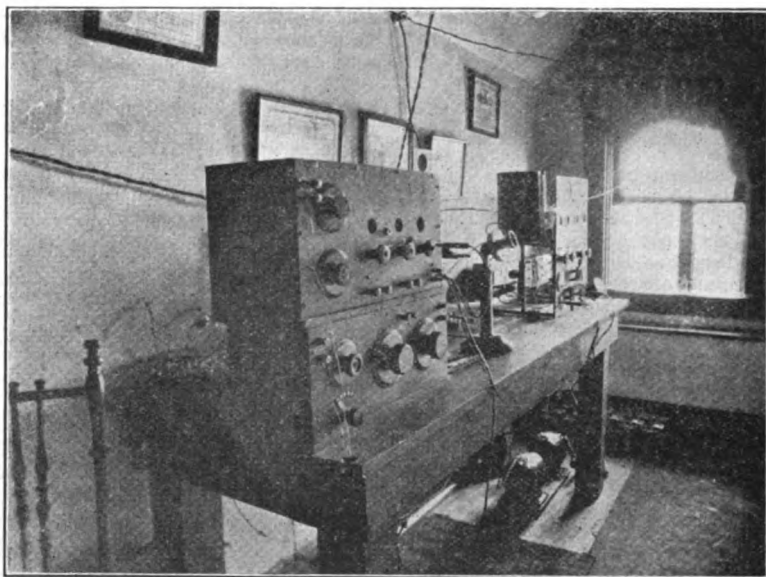
# Amateur Radio Stations



## 8LF, Crafton, Pa.

The CW transmitter at 8LF constructed by Mr. W. K. Thomas is most interesting and deserves much praise for its phenomenal work in the past few months. As announced in our last issue its signals have been heard in the Pacific by a ship opera-

are mounted on a sub-panel, below the tube shelf. The controlling switches for selecting phone, buzzer modulated or straight CW are mounted on the main panel as well as controls for filament current and plate supply. The main antenna inductance



The Interior Arrangement at 8LF

tor at a distance of 5500 miles from Crafton, Pa. West coast stations have repeatedly heard it and its relay work has been of the highest order.

The antenna consists of six wires 65 feet long supported by two masts at a height of forty five feet. A counterpoise is used, being a duplicate of the antenna and supported 10 feet from the ground by the antenna masts.

The tube transmitter is mounted on an open panel and uses four 5-watt Radiotrons. The tubes are mounted on the upper shelf to the rear of the panel and the condensers, chokes and modulation transformer

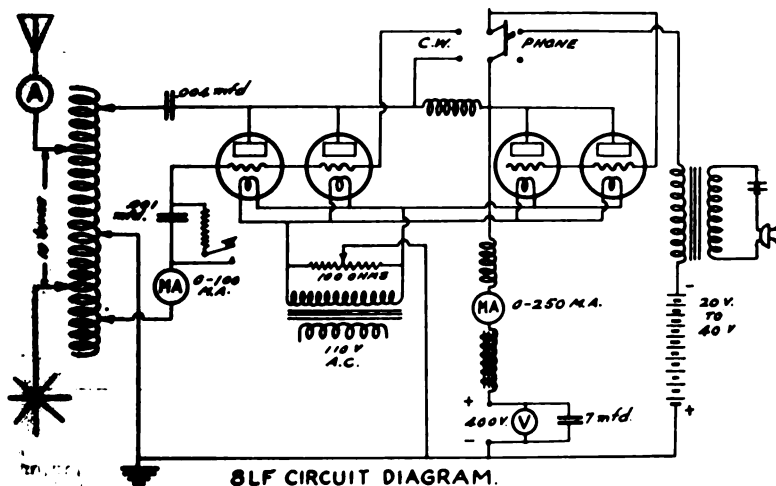
may be seen mounted back of the tubes. The source of plate supply has been an ever-changing feature and good success has been had with both motor-generator supply and chemically rectified alternating current. The rectifier consists of twelve pint jars connected in the usual circuit, the construction of which is similar to those that have been described in the past issues of QST. Mr. Thomas, however, finds that the aluminum plates when made three times the size of the lead plates give better rectification. The antenna current with the rectified alternating current plate supply is approximately 2.4 amperes, corres-



ponding to an output of 46 watts the arrangement of which is clearly shown in the accompanying circuit diagram.

The receiving equipment consists of a Grebe CR-2 with a detector and two steps

of audio amplification, also a Westinghouse single-circuit receiver with detector and two step audio. Mr. Thomas finds a single circuit receiver much better for continuous wave reception.

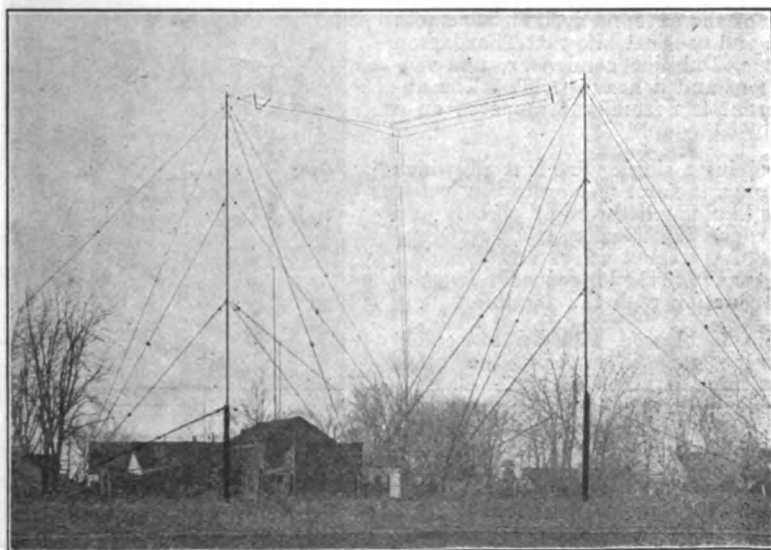


## 9MC, Roodhouse, Illinois

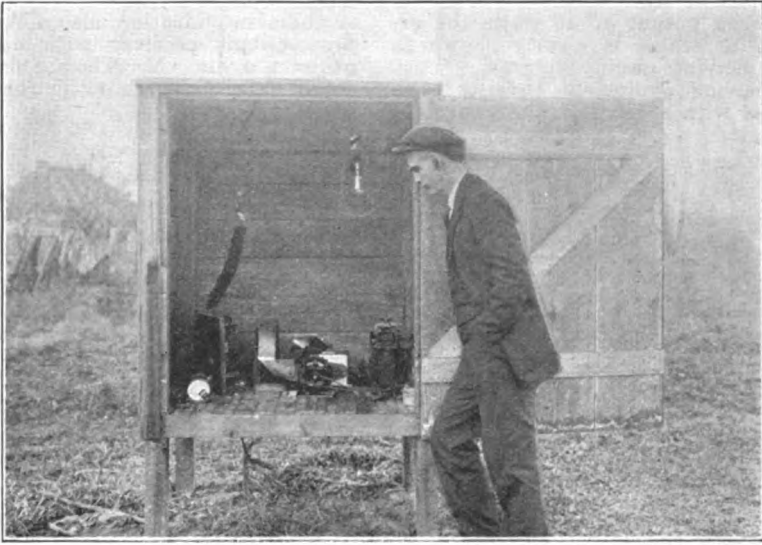
The accompanying photographs show the efforts of Mr. A. H. Cain in producing a most successful station. Some very exceptional distances have been covered for

a spark station, 9MC having been heard in Maine, New Hampshire, Oregon, Idaho, Nevada, and Arizona.

The antenna is supported by two iron



9MC's Antenna



Mr. Cain and his transmitter

pipe masts 80 feet high and consists of a five-wire flat top T, 65 feet long. The lead-in drops straight down to the secondary of the O. T. without any crooks or bends. The whole system has been very carefully laid out and each guy wire is insulated at frequent intervals. The ground system was installed at the suggestion of Mr. M. B. West and consists of twelve galvanized rods five feet long driven into the ground and a buried counterpoise using 7000 feet of wire in a radial form.

The transmitter, located in a hut under the center of the antenna system, is remote controlled and uses a 1 kilowatt Thordarson transformer, Dubilier condenser, non-synchronous gap and a heavy O. T. The antenna current is normally 4 amperes on a Jewell thermo couple.

For receiving a single wire is used, which Mr. Cain says is far superior to any other and gives him much stronger signals and tunes sharper, with less strays. A Grebe CR-2 is used for short waves and a honey-comb-coil tuner for the longer wave lengths, both in conjunction with the amplifier.

Mr. Cain is blessed with an extremely fortunate location, there being no other stations within 45 miles of him. The receiving set and transmitting controls are located in Mr. Cain's garage office and the only QRM he experiences is from customers, which he terms "commercial QRM."

9MC is one of the important stations in the Central Division and handles considerable traffic. It is one of the most consistent stations in its territory and Mr.

Cain's fist is a very familiar one to operators in the middle-west. It is evident from the photographs that nothing has been spared to make 9MC a real stations and Mr. Cain can well be proud of his efforts.



# With Our Radiophone Listeners

## *Getting Started Listening*

THE really good radiophone broadcasts now being put out have brought thousands and thousands of people into the amateur radio game who would never have made the plunge for the telegraphic features of the art and whose major interest at present lies in the reception of the radiophones. We have had many hundreds of requests for advice in getting started in the listening game and it is in the hope of being of help that we present the following.

The most bothersome feature of the whole business is the aerial or antenna, yet it can be reduced to a very simple problem. This aerial is a kind of "collector" against which the advancing radio waves impinge, inducing in it a feeble voltage which maintains a minute electric current oscillating at high frequency. To best serve as a collector our aerial should be of the proper dimensions so as to cover the right range of wave lengths, should be located where the waves can impinge upon it effectively, should be of low electrical resistance so that the losses in it are at a minimum, and should be well insulated from its supports and kept away from other objects so that its small energy may be conserved and delivered to the apparatus.

Aerials work better as they are made higher but fortunately this is more pronounced in transmitting aerials than in those for receiving, and furthermore a lower aerial picks up decidedly fewer "strays" or atmospheric disturbances ("static"). It is also fortunate that, while an aerial for transmitting has to have numerous wires arranged in intricate formation and supported by complex "spreaders" or cross-members, incidentally necessitating sturdier supports, a receiving aerial may consist of but a single length of wire. In fact we feel that there is not the slightest to be gained in using more than one wire. This simplifies things considerably—we now know that a single length of wire, not unduly high, and capable of support by light masts, will suffice.

Now for the dimensions. Amateurs get results on almost anything—the clothesline, the telephone line, bed-springs, the

kitchen range, twenty feet or so of wire run thru the house or hung on a picture moulding, etc. But the better way, of course, is to run a wire outdoors where it can effectively "collect" our signals. For best results it ought to be about 50 ft. high if possible, but excellent results are had at 30 ft. and very fair reception accomplished at as low as 20 ft. Of course the higher it is, other things being equal, the louder the signals and the greater the distance over which they may be received. The length of the wire, within available space, will depend upon the wave lengths to be received. The standard broadcasting wave is 360 meters and our aerial should be of a length that will give best results at that figure and if possible still be capable of getting up to the ship wave length of 600 meters and down to the amateur waves in the vicinity of 200 meters. From practical experience it may be said that the best over-all length for an aerial for this purpose is around 175 feet. Good results can be got with much shorter aerials if necessary, and aerials of 200 ft. will give slightly better results on the concert wave, perhaps, but at the expense of 200 meter reception. By over-all length is meant the length from the tuning apparatus to the far end of the antenna. For example, for 175 ft. over-all the aerial may run 10 ft. across a room, thru a window and up 40 ft. to the start of the horizontal portion, and then stretch away for 125 ft. to the far support.

The aerial wire may consist of solid copper, No. 14 or 12 B&S gauge, or of the stranded copper wire available for that purpose. Bare wire is preferable to insulated, altho the latter can be used. Phosphor-bronze wire is desirable for especially long spans or where winter sleet is heavy, its chief advantage being superior tensile strength.

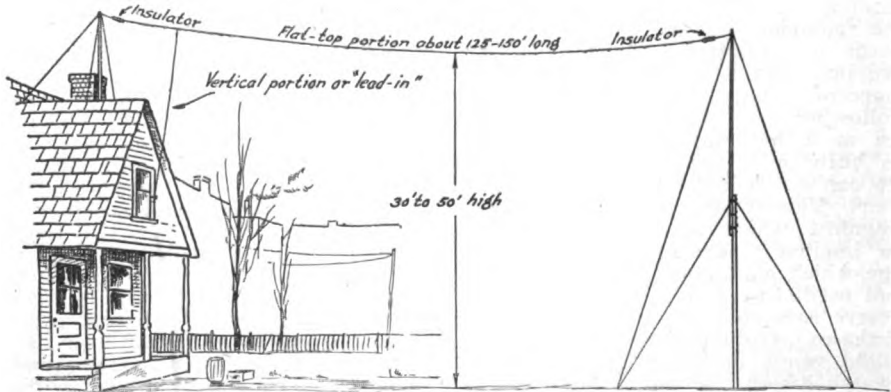
For best results the aerial should be run in a straight line between two supports, and not run around corners via intermediate supports, altho slight changes in direction will not particularly detract when unavoidable if care is given the insulation at the intermediate supports. Differences in height at the opposite ends of the aerial do not make much difference but it is pre-

ferable, where possible, that the "far" end be as high as or higher than the "station" end. The sketch herewith will give some ideas on the rigging of an aerial. Often a short mast may be put on the house and used to support one end, and a similar mast on another house or garage, or even a special light mast or a tree used for the far end. The wire should be run in a direction where it will be as far as possible from trees and buildings, particularly structures having metal roofs, etc. And whenever possible it should run at right angles to power and lighting wires, so that the latter will not induce a "hum" in the apparatus.

The aerial should be carefully insulated at both ends. Standard insulators are available for this purpose, or glazed porce-

by connecting to the cold water supply, preferably as near the street as possible. It is impossible to solder a wire to a cold-water pipe, but little "ground clamps" can be had in the supply stores which make this unnecessary. The pipe should be carefully scraped all around at the desired place, until the metal is bright and clean, and the clamp tightened down snugly. While the lead-in wire should be carefully insulated, and a bare No. 14 wire will do nicely. It should be soldered at its far end to the ground clamp previous to placing the latter around the pipe.

In our next issue we will give further suggestions along this general line.



lain "eggs" or porcelain cleats may be used, preferably several in series at each end. The lead-in or vertical portion of course is attached to the flat-top portion, next to the insulator, and should be a soldered joint.

The underwriters' present regulations require that the lead-in should be run to the blade of a single-blade double-throw switch outside the building, so arranged that in one position it connects the aerial to an insulated wire running inside the house and in the other position grounds the aerial to earth thru a special out-door ground connection for lightning protection. These regulations are in process of revision at the present time and it is believed that the new regulations will abolish the necessity for such a switch and permit the use of a minute "knife-edge" air gap to earth, instead. More about this later.

In addition to an aerial, wireless sets require a "ground" or connection to earth. Transmitting stations require a rather elaborate ground system but this is not necessary for receiving alone. Connection to the radiator system or gas pipes will give fair results, but better ones will be had

#### Wireless Market Reports Used by Many Agencies

The wireless is now being used by State and Federal agencies to broadcast national and local agricultural market reports throughout virtually the entire country. Reports on the national markets are dispatched daily by the United States Department of Agriculture from wireless stations of the Post Office Department at Cincinnati, Omaha, Washington, North Platte, Nebr., Rock Springs, Wyo., Elko, Nev., and Reno, Nev. These reports are received by hundreds of amateur wireless operators. National market reports are also received by State bureaus of markets and agricultural colleges, supplemented with local market reports, and relayed by wireless telegraphy and telephone to farmers, shipping associations, newspapers, banks, and other agricultural interests.

The St. Louis University at St. Louis, Mo., was perhaps the first among educational institutions to broadcast market reports by wireless. These reports are received by hundreds of farmers, shipping associations, banks, and other agricultural

interests, and a telephone company in eastern Illinois which receives the reports telephones the news regularly to its 5,000 subscribers.

At Lincoln, Nebr. the University of Nebraska and the Nebraska Wesleyan University are co-operating in broadcasting crop and market reports furnished by the State Bureau of Markets. Both radio telephone and telegraph are used. At Wisconsin the State Department of Markets broadcasts national and local market reports from the University of Wisconsin wireless station at Madison. At Minneapolis, crop and market reports are broadcasted from the University of Minnesota radio station. The Minnesota College of Agriculture has also assigned an extension representative to instruct the farmers in the use of wireless receiving apparatus. The College of Agriculture of Cornell University has assigned an expert for similar work, and to assist rural radio clubs that are being organized in New York.

A high-powered transmitting wireless telephone has been installed in the office of the Missouri State market bureau at Jefferson City, Mo., and started disseminating market information about January 10. Government reports from the larger market centers of the country will be received by means of a "drop" from the leased wire system of the United States Department of Agriculture, and transmitted by radiophone to all sections of Missouri. Demonstrations intended to interest farmers, dealers, and shippers in installing the necessary wireless receiving apparatus will be held in various rural communities of the State, and it is anticipated that telephone offices, newspapers, chambers of commerce, county agricultural agents, banks, high schools, and co-operative marketing associations will be among the first to install receiving sets.

A most complete program in the dissemination of market reports by wireless is being planned by the State bureau of markets in Ohio, a specially constructed radiophone transmitter of the most improved type being installed in the radio station of the University of Texas markets and warehouse departments are also planning a market news service by radiophone for farmers, dealers, and shippers in Texas, arrangements being made to use the radio equipment of the University of Texas at Austin.

The first national market report to be broadcast by wireless anywhere in the world was sent out by the United States Department of Agriculture from the radio station of the United States Bureau of Standards only a little over a year ago. The department soon demonstrated the practicability of utilizing the radio for disseminating market information, and rapid progress in expanding the work has been

made possible through the cooperation of State and Federal agencies. To make the American farmer the best informed farmer in the world is the aim of these agencies, and equal progress during the coming year will go far toward securing that result, say officials of the Federal department.

#### **NOF-NSF Concerts Again Started Through Washington Cooperation.**

At the suggestion of Mr. A. J. White of White and Bover Co. a collection was taken at a recent Washington Radio Club meeting and sixty dollars raised in ten minutes to purchase a phonograph for "LC" Young so that he could again send radiophone concerts from NSF.

Mr. "Call-me-Henry" Lansburgh of Lansburgh and Brother not only was for the idea but refused the sixty dollars entirely and presented Young with a \$75 Victrola and advised the club to use the money for records. This is being done, Young acting as trustee.

NSF now has two calls. NSF is used for official business and NOF for broadcasts. The concerts are given Tuesdays, Wednesdays and Fridays.

Amrad WGI of Medford Hillside, Mass., is running a repeat broadcast of the Public Health Service lectures as given from NOF, at 8:15 pm Eastern Standard Time on 310 meters.

The Seattle Post-Intelligencer, a large morning daily of Seattle, has installed a complete radiophone transmitter and is broadcasting concerts daily including Sundays from 9:00 to 9:30 pm. These broadcasts, in addition to music, include late news items of the day with special features as available. The transmission is on 325 meters and the power at present is but five watts. In spite of the low power their signals have been heard repeatedly at distances up to 1500 miles, Spokane, Washington, reporting them consistently every evening, a distance of about 350 miles. Arrangements have recently been completed for increasing the power to one hundred watts and the erection of a better antenna. The new transmitter will be in operation very shortly, having a much greater range.

The station of the Atlantic Pacific Radio Supplies Company, located at the California Theater in San Francisco has been removed to Oakland and installed in the home of Mr. H. M. Shaw, President of the Atlantic Pacific Radio Supplies Co., where it is planned to make extensive experiments in the broadcasting of music.

The transmitter is of 500 watts capacity and is a DeForest Oscillion transmitter. It has been reported from all points on the Pacific coast and at Wailuku, Maui, Haw-

(Concluded on page 51)



**T**HE A. R. R. L. has the pleasure of announcing the completion of affiliation of the following societies as of Jan. 14, 1922:

Hackensack Radio Club, Hackensack, N. J.  
Totem Radio Club of Seattle, Seattle, Wash.  
Northern Wayne Radio Club,

Williamson, N. Y.  
The Chelsea Radio Ass'n, New York City  
The Ion Radio Ass'n of Milford, Mass.,  
Milford, Mass.

Radio Club of Hudson County,  
West Hoboken, N. J.

Newark Radio Traffic Ass'n, Newark N. J.  
The Pawcatuck Valley Radio Ass'n,

Westerly, R. I.  
Poultney Executive Radio Council,  
Poultney, Vt.

Radio Institute of Binghamton,  
Binghamton, N. Y.

The Hotchkiss Radio Club, Lakeville, Conn.  
Roselle Park Radio Club, Roselle Park, N. J.  
St. Thomas Radio Club, St. Thomas, Ont.  
St. Joseph's College Radio Society,

Philadelphia, Pa.  
Lansdowne -Radio Ass'n, Lansdowne, Pa.  
Carson Amateur Radio Ass'n,

Carson City, Nev.  
New London Radio Club,

New London, Conn.  
Lewisburg Radio Club, Lewisburg, Pa.

Tesla-Marconi Club, West Allis, Wis.  
The Harrisburg Radio Club, Harrisburg, Pa.

The Rose City Radio Ass'n,  
Springfield, Ohio

The Logan County Radio League,  
Bellefontaine, Ohio

Champaign County Radio Ass'n,  
Urbana, Ill.

Radio Engineering Society, Salem, Mass.  
The Wooster Radio Club, Wooster, Ohio

Clubs wishing information on how to become affiliated with the A. R. R. L. can secure same by addressing a letter to the Traffic Manager, A. R. R. L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. Every radio club, association, or society is eligible for affiliation and information will be given to those who desire it.

**The Mystic Valley Radio Club** of Malden, Mass., has been re-organized and new officers elected: Earl Baker, pres.; Mr. Ham-

ilton, vice-pres. Meetings are held weekly at the YMCA. A complete station has been installed with watches kept every night except Sunday.

**The Flint, (Mich.) Radio Association** was organized in October, 1921, with a membership of 35. This number has been increased to 61. The association is operating under a governing executive council interested in traffic control and promotion of radio. Demonstrations, with carefully selected programs, are given regularly for the benefit of amateurs in and around Flint. The Board of Education of Flint has introduced radio into the night courses and prepares students for government examinations.

Nearly one hundred new members were added to the roster of the **Providence Radio Association** when a radio fone concert was given for the benefit of the Boy Scouts of America. The transmitter was at 1CIV and a four step amplifier was used in the large hall where the meeting was held. After the demonstration memberships were solicited and the above number secured.

At a recent meeting of the **Ann Arbor, (Mich.) Radio Association**, Dr. N. H. Williams of the Univ. of Michigan read an interesting paper on "How Our V.T. Circuits Oscillate." A heated discussion was held on the subject, "Simplified Versus Triple-Tuned Receivers." The membership of the club has grown during the past year and several instruments have been purchased which may be borrowed by any member.

Amateurs on the Pacific Coast have adopted a plan known as the "Pacific Plan," which is similar to the Chicago Plan in its purposes. There are five divisions of operating hours each day:

6:30 A.M. to 6:30 P.M., free air, work of any kind except DX.

6:30 P.M. to 7:30 P.M. or up to concert time, for local traffic only, using minimum power.

7:30 P.M. to 9:00 P.M., concert period when concerts are broadcasted or in districts where there will be QRM from 200

meter stations. This is under individual control of clubs in their locality.

9:00 P.M. to 10:30 P.M., long distance testing and messages to DX stations only. Stations working in this period cannot work again until after midnight.

10:30 P.M. to midnight, DX message traffic only, for stations having regular traffic except those who worked during previous period.

12:00 A.M. to 6:30 A.M. DX testing and DX free air.

Each radio club has appointed a traffic officer whose duty it is to supervise traffic regulations in his territory.

**The Cleveland (Ohio) Radio Association** has adopted and enforced traffic regulations so perfectly that not one case of QRM was reported during the concerts given by the Association. A prize is given each month for the best message report turned in by a member of the C. R. A. The members meet in the Hotel Statler. One of the novel features of eliminating QRM or rather proving that a station caused QRM is the use of a dictaphone which records everything. The records are at the disposal of the traffic committee and every record is authentic. At one of the meetings some of the records were played. The signals were heard all over the hall and some of the fellows fearing exposure started to leave the room. In addition to the dictaphone record, a complete log is kept which is sworn to by the operator making it. Team-work is the motto of the C. R. A. and in spite of the fact that there are several hundred transmitters in Cleveland, QRM is almost nil.

**The Radio Club of Hartford** held its annual election of officers on January 9th, electing F. H. Schnell, president; J. C. Randall, vice-president; R. C. Higgy, secretary-treasurer. An executive committee consisting of the above officers also includes C. D. Tuska, K. B. Warner, R. S. Miner, and Perry Briggs.

**The Southern California Radio Association (Los Angeles)** has a membership of 200. Meetings are held the second and fourth Mondays of every month in a large hall capable of accommodating 500 people. Membership drives have not been held, but the membership has grown because of the fact that the meetings are of such interest that every member brings a member. A banquet is held every few months which always brings out a large enthusiastic crowd. Much of the success of the S. C. R. A. is due to the untiring efforts of Lex Benjamin, its president.

## WITH OUR RADIOPHONE LISTENERS

(Concluded from page 49)

allian Islands, a distance of 2100 miles. Arrangements have been completed for the broadcasting of phonograph music, late news items and concerts. Every afternoon and evening except Sunday news and music will be transmitted at 3:30 to 4:30 p.m. and from 7:00 to 7:10 p.m. On Wednesdays a concert will be given from 2:30 to 8:15 p.m. and on Saturdays from 8:15 to 9:00 p.m.

The California Theatre station was installed in April, 1920, by Lee DeForest, Inc., and had the distinction of being the pioneer station in the world for the sole purpose of broadcasting, having transmitted some 1500 concerts before its removal to the more efficient location in Oakland.

## BROADCAST SCHEDULES OF NOF (Eastern Standard Time)

(Aircraft Radio Laboratory, Naval Air Station, Anacostia, D. C.)

**FRIDAYS:** Wavelength—365 Meters

8:30 to 9:00 P.M.—Musical Program

9:00 to 9:15 P.M.—Lecture by U. S. Public Health Service (By distant control from Public Health Offices)

9:15 P.M. to 9:45 P.M.—Musical Program

**TUESDAYS:** Wavelength—1100 Meters

4:00 P.M. to 4:15 P.M.—Musical Program

4:15 P.M. to 4:30 P.M.—Lecture by U. S. Public Health Service (By distant control from Public Health Offices)

**WEDNESDAYS:** Wavelength—365 Meters

8:30 P.M. to 9:00 P.M.—Musical Program

9:00 P.M. to 9:15 P.M.—Repeat Lecture by U. S. Public Health Service

(By distant control from Public Health Offices) on wavelength of 365 Meters.

9:15 P.M. to 9:30 P.M.—Musical Program

## Radiotelephone to Send Weather Forecasts and Warnings

Beginning January 16 the air mail radio station in the Post Office Department at Washington has been broadcasting weather forecasts and warnings of the Weather Bureau, United States Department of Agriculture, by radiotelephone instead of by radio telegraph. These reports are sent out for the District of Columbia, Virginia, Maryland, West Virginia, eastern Pennsylvania, and Ohio. In sending out this information a wave length of 1160 meters is used and all receiving instruments as far west as Ohio if properly tuned receive the reports, which are sent out at 10 a.m. and 9:50 p.m. Experience has shown that the radiotelephone gives better and more rapid service than the radiotelegraph.



# Strays



Numerous requests have been received asking that a spark coil column be inserted monthly in QST. We would like more suggestions and material for this column in order that we may start this in an early issue.

Arthur Lillie, canadian 3HB, recently put on a radio program at the Pacific Hotel in North Bay, Ontario, reproducing music from Pittsburgh and Newark loud enough to be heard by the entire audience.

Dr. S. J. Blum, 9FM, asks that we make note of the correction of his address as 3930 Campbell St., Kansas City, Mo., and not Collegeville, Minn., as in the latest call book.

In the article "Comments on the Sure-Fire C.W. Circuit" by Mr. Shaw in the January QST a very serious error was made in the circuit diagram of Fig. 3. A blocking condenser of around .002 mfd. should be inserted between the antenna inductance and the plates of the tubes. Otherwise the high voltage generator is short-circuited.

Our printer must have been standing on his head when that page was printed, as this diagram is upside down in some of the copies.

E. T. Cunningham of the Audiotron Manufacturing Company has issued a friendly warning calling attention to the fact that imitation two-filament audiotrons have appeared recently bearing the same label as the good old audiotrons of the past, the manufacture of which was stopped October 1920. Beware!

S. Kruse has left the Bureau of Standards and is now located at Cruft's Laboratory, Harvard University, engaged in experimental work for John Hays Hammond, Jr.

Division Manager Corlett of the West Gulf Division and Porter T. Bennett, Secretary of the Dallas Radio Klub, deserve much credit for their enthusiastic boosting and getting new members for our A. R. R. L. They even have brought in new mem-

bers from Mexico, Rip's Spanish seeming to produce some wonderful results.

In a recent patent controversy between the Radio Audion Company and the Radio Corporation of America a decision was given by Judge Hugh M. Morris, for the District of Delaware, giving the Radio Audion Company the right to continue the manufacture and sale of three-electrode amplifiers and oscillators. The Radio Corporation claimed an infringement on the Fleming patent for two electrode rectifiers. The result of prior litigations based on the same patent has been that the Radio Corporation was the only firm permitted to manufacture three-electrode tubes.

"Calls Heard" has become one of the important features of QST and enough material is received monthly for a hundred pages. Only lists submitted before the tenth of the month preceding the date of issue and containing calls heard in the previous calendar month are acceptable for publication. Get your lists right!

5ZT, Mr. I. S. Roberts of Houston, Texas, requests that we make note of the fact that his old call 5AN, has been assigned to A. W. Phillips of McAllester, Oklahoma, after receipt of his special license.

"Radio Questions and Answers" (92 pp., pocket size, McGraw-Hill) by Arthur R. Nilson, Director of the East Side Y. M. C. A. Radio School, New York, is a valuable book for the man preparing to take the commercial operator's examination. It contains eight chapters of questions and answers and general information as to license requirements and grading. The questions cover the theory of radio and electricity and all other matter contained in the government examinations. It is available from QST Book Department at one dollar postpaid.

9ASU says that calls are getting scarce, so much so that the Government has issued half calls. If you don't believe it look up 8IS ½ in the new call book.

Edwin C. Adams, QST's advertising manager, was married on Jan. 18th to Miss Hazel O. Haynes, of Hartford. And still February QST got out on time!

8DE has been reassigned, City Manager R. F. Palmer of Akron having got married without warning and pulling up stakes for Los Angeles, from where he advises us that he has to look after the O.W. and has no more time for radio. How long do we give him, fellows?

#### Read 'Em and Weep

4BY was reported QSA in Long Beach, Calif., by 6ALP, Mr. H. M. Brown. 4BY and 4GL have been heard on board the S. S. Kokimaru by F. L. Jones while 1275 miles west of Portland, Ore. Mr. Jones reported them nightly while proceeding up the west coast from Lower California to Portland.

XF1 has been copied in Hawaii by 6ZAC. 3EM, Duvall of Baltimore, was copied by 6XAC of Avalon, Santa Catalina Island using one fifty watt.

6KA, Nikirk of Los Angeles, reports 8XV, 8AGZ, and 8BK, all QSA.

1BOX reports hearing 6ZA, latter using one 50-watt.

8XV has been copied at 6EN, Los Angeles, for a period of two weeks.

8AGO of Pittsburgh was heard by 6XAD of Avalon.

6AHP in Pomona, Calif., reports 8DR, 8BUM and 8BRL during January.

5ZAK, at Camp Travis, San Antonio, Texas, 5-watt phone, has been heard on voice in New Rochelle, N. Y.

8AGK got a 500-watt tube recently and built a C.W. set, then took a shovel and ousted the spark. All went well until the key was pressed the first time. The loud explosion you heard was what happened. Now he's after a grave-digger to get back the coffin he buried.

Lester F. Bather, loyal member and supporter of the A. R. R. L. and secretary of the Detroit (Mich.) Radio Assn., departed this life on Nov. 10th at the age of nineteen, following an unsuccessful operation for appendicitis.

We join with Detroit amateurs in the deepest sorrow at this loss. Bather was an exceptional lad, competent as a club officer, a proficient amateur, enthusiastic in all co-operative endeavors, beloved of his associates. Our sincere sympathy is with his parents in their bereavement.

The wonderful distances now being accomplished by short-wave CW make one wonder where the end is. That limit, friends, shortly will be determined only by the maximum distance on earth, roughly

12,000 miles. The greatest distance from any point on this sphere is the point diametrically opposite it on the other side of the earth, known as its antipodes.

In view of the successful Transatlantics and Transpacifics it isn't out of order to study a globe a bit and pick out a hard task for our next tests. Peculiar radio conditions are known to exist at antipodal points, and it is anticipated that reception there will be much better than at many intermediate distances. So we have dusted off our old globe and take a look-see. The general territory in which we are interested is roughly that lying between Australia and Africa, in the South Indian Ocean. Unfortunately there is but little dry land there, unless it is uncharted islands, so we suspect we will have to send a ship expedition when the time comes. However, we do find the Amsterdam Islands and St. Paul Islands (French), located in the antipodes of western Kansas, and the Island of Desolation (also French) roughly in the antipodes of Saskatchewan and Montana. Western Australia unfortunately is the antipodes of a point in the Atlantic ocean roughly midway between Porto Rico and Bermuda, while no dry-land antipodes can be found for the northeastern portion of our country in which many excellent CW stations are located.

Are there among QST's readers any ship operators who traverse this territory—or any readers who would care to move to Desolate Isle in quest of signals?

With deep regret we chronicle the accidental death on December 3rd of William Dawson, of 8PW, Charlerio, Pa. Mr. Dawson was electrocuted while erecting an aerial at Fayette City, when an aerial wire he was stringing came in contact with a 6600-volt line, notwithstanding that some two hundred feet of aerial between him and the line remained in contact with the ground. Mr. Dawson was a very active amateur for the last several years and lately his voice had become a familiar one thru his radio-phone. His many friends mourn his loss. Let this accident be a warning to all of us who are frequently exposed to these dangers.

#### New Apparatus

Notable in the way of low-priced apparatus is the Harko Senior receiver of the Crosley Manufacturing Co. A cabinet with formica panel contains a non-regenerative three-tap tuner, a Crosley variable condenser, and a Crosley socket for the tube, the wave length range being 150 to 600 meters. Remarkable results are obtained on this set, KDKA, WJZ, ships at sea, and countless nearer stations being clearly heard in Cincinnati without amplifiers.

# Calls Heard



## HEARD AT SEA

Ex-1AVA—At Port au Prince, Haiti: 1BCG, 1XM, 2AAB, 2OM, 3HJ, 4GL, 8AML, 8BOX, 8ZAC.

SN—1650 miles N. E. New York, Dec. 25: 1AKB, 1ARY, 1BCF, 1AFV, 1CAK, 1ZE, 2AAB, 2FP, 2NZ, 3BEZ, 3IW, 3MO, 4BY, 4GX, 4GL, 8AIL, 8AWP, 8BFX, 9AJA.

EX-2AFT Dec. 6, Jan. 15.—Crystal off Hatteras: 1AW, 1GM, 1ARY, 2EL, 2OM, 3AHK, 3AQR, 3BME, 3AK, 3BG, 3IJ, 3XM, 4BX, 4CX, 4FD, 5DA, 5YL, 8AFD, 8AHH, 8AJT, 8AYN, 8BRL, 8SP, 8VL, 8YM, 8ZN, 9AOE, 9DCX, 9DHz, 9HR, 9LF, 9MC, 9TL, 9TR. Off Cape Henry, Va.: 2AER, 2EL, 3AHK, 3AQR, 3BG, 3VS, 4BX, 8DP, 9GX. Off Charleston, S. C.: 1BDT, 2FP, 3AHK, 3XM, 4BI, 4BY, 4CX, 4AM, 5XA, 5XU, 5ZL, 8ACF, 8YAA, 8UC, 8XE, 9AAW, 9ACB, 9DCX, 9UU, 9YM. Off Jacksonville, Fla.: 2EL, 2FP, 4FD, 4YB, 5DA, 5XA, 5ZL, 8BVA, 9ACB, 9ACR, 9MC.

### Canadian 2BT, Montreal, Que.

Spark: 1GM, 1OJ, 1ABY, 1AEV, 1AMD, 1APO, 1ARY, 1BIR, 2BY, 2FP, 2OM, 2XQ, 2AJE, 2ASL, 3AN, 3BG, 3NB, 3PU, 3HB, 3XM, 3ARB, 3AFK, 3AQR, 5XU, 8JJ, 8SP, 8TT, 8UY, 8VN, 8XE, 8ZAA, 8ZAC, 8ZP, 8AFD, 8AFG, 8AKQ, 8AMS, 8ASL, 8AXO, 8AXQ, 8BXC, 9CA, 9GO, 9II, 9UU, 9UW, 9ZJ, 9AAW, 9ACY, 9DSO, 9DWP, Can: 3BP, 3KG.

C.W.: 1GV, 1QN, 1RZ, 1TS, 1UN, 1AFV, 1AIP, 1ARY, 1AZW, 1BCF, 1BDI, 1BEA, 1BEP, 1BKQ, 1BQE, 1BWS, 1BYK, 2RM, 2TJ, 2VH, 2AAB, 2AIL, 2AKO, 2ALR, 2ANZ, 2AWF, 2BGH, 2CBT, 3CG, 3HG, 3MO, 3SM, 3TJ, 3ZO, 3ZM, 3ZY, 3AAE, 3ADT, 3AQR, 3ASV, 3BEC, 3CBW, 4BQ, 4BY, 4EL, 4GL, 4ID, 4FS, 5UU, 8BK, 8DE, 8HJ, 8II, 8IQ, 8JL, 8RZ, 8UJ, 8UK, 8ZG, 8ZAE, 8ABV, 8AGO, 8AGZ, 8AIV, 8AML, 8AMS, 8AXO, 8AZV, 8AZX, 8BFX, 8BOX, 8BRC, 8BRZ, 9BO, 9DV, 9PC, 9TV, 9US, 9YC, 9AAS, 9AAV, 9ACN, 9AKD, 9ANG, 9BBF, XF1, CF2, Can. 9AL.

### 3GN, Ingersoll, Ont.

Spark: 1ZE, 1AEV, (1APO), 1ARY, 1AZK, 1BCF, 1BDI, 1CNI, 2BM, 2CI, 2FP, (2OM), 2XQ, 2ZL, 2AJE, 2ARK, 2BJO, 3AN, 3CC, 3CN, (3HJ), 3LP, 3NB, 3OU, 3PU, 3QN, (3QW), 3TA, (3XM), 3XQ, 3YV, 3ZA, 3ZL, 3ZO, 3ABB, 3ACE, 3AFU, 3AHK, 3AJD, 3ANE, (3AQR), 3BFU, 4AG, 4EA, 4GN, 5ER, 5FJ, 5ZZ, 5ZL, 8AY, 8CH, (8CP), 8EA, 8EB, 8FI, 8HS, 8IP, 8JJ, 8JW, 8LB, 8LQ, 8NO, 8OE, 8OI, 8PL, 8SM, 8SP, 8VH, (8VW), (8WD), 8WE, 8WO, 8XE, 8XS, (8YM), 8YN, 8ZP, 8ZW, (8AAV), (8AFB), 8AFD, 8AFG, 8AHH, 8AHQ, 8AIZ, 8AJK, 8AKQ, 8APP, (8ARD), 8ASG, 8AUE, 8AWZ, 8AXN, 8AYN, 8AXY, 8BAZ, 8BBI, 8BCK, (8BYD), 8BEP, 8BFH, 8BGT, 8BHV, 8BQC, 8BRL, 8BZY, 8CGX, (8ZAC), 9AS, 9AV, 9CA, 9DF, (9ET), (9FS), 9CG, 9HI, 9JN, 9JQ, 9LW, 9MC, 9OX, 9PI, 9SM, 9UU, 9YQ, 9ZC, 9ZJ, 9AAP, 9AAW, 9ACL, 9ACN, 9ACY, 9AEK, 9AIU, 9AJP, 9ALP, 9AMQ, 9AOE, 9AOU, 9ARZ, 9ASJ, 9ASK, 9ATV, 9AUV, 9AVF, 9DCX, 9DHz, (9DKV), 9DQ, 9DWD, 9DYU, 9DZI, 9YAC, Canadian (3AX), (3BA), 3BP, (3DL), 3EP, 3GE, 3IJ, 3JO, 3KE, 3LI, 3LP, (3MN), (3NV), (3NZ), (3OV), (3PM), 3QC, (3QH), (3QJ), 3RH, (3RV), 3RY, (3TA), 3TB.

C.W.: (1TS), 1XE, 1ARY, 1AYL, 1BDI, 1BKQ, 1BWJ, 2ZL, 2AAB, 2BEB, 3CA, 3GH, 3MO, 3RF, 3TJ, 3AAD, 3AHK, 3ASV, 4BQ, 4BY, 4EL, 4GL, 4ID, 5FV, 5UU, 8BK, 8CD, 8DR, 8HJ, 8IQ, 8IV, 8JW, 8OI, 8OS, 8SP, 8UJ, 8VY, 8XK, 8AFB, 8ABO, 8AGL, 8AGZ, 8AIO, 8ALB, 8ALD, 8AWP, 8AWY, 8AWZ, 8BBK, 8BEX, 8BFX, 8BOX, 8BZJ,

8BZO, 8CAZ, 8CEP, 8XAV, 9LL, 9ZL, 9AIH, 9AJA, 9AJF, 9AKR, 9ALS, 9ARK, 9BAP, 9BBF, 9DZQ, Canadian (3FM), (3LW).

### 5CZ, Vancouver, B. C.

Spark: 6ARD, 6KI, 6KG, 6LX, 6QR, 6ZAM, 6ZK, 6ZX, 7BH, 7BJ, 7BR, 7HF, 7BZ, 7BC, 7CH, 7CN, 7CK, 7FI, 7GE, 7IW, 7JR, 7KJ, 7KE, 7KB, 7LY, 7MU, 7MF, 7MP, 7NN, 7NL, 7NW, 7OJ, 7TJ, 7TL, 7VZ, 7VX, 7YA, 7YJ, 7ZJ, 7ZT, 7ZY, 7ZU, CL-8.

C.W.: 5AK, 5AU, 5EN, 5ZX, 5ZA, 6AAT, 6AAC, 6AK, 6ATG, 6BCJ, 6EN, 6PP, 6VV, 6XAC, 6XAD, 7AAV, 7CF, 7EN, 7FT, 7IL, 7KV, 7KZ, 7NN, 7OG, 7RN, 7UZ, 7XF, Can. 4CB, 9AMB, CL8.

### 1BT, Worcester, Mass.

1ABY, 1AMD, 1AMG, 1AMS, 1AMY, 1ARY, 1ASJ, 1AVI, 1AVR, 1AZW, 1BDC, 1BEA, 1BES, 1BIR, (1BKQ), 1BKR, 1BQE, 1BRJ, 1BYN, 1CAK, 1CAN, 1CGS, 1CIR, 1CKR, 1CLI, 1CLZ, 1CNF, 1CNR, 1CUF, 1DZ, 1HE, 1PT, 1QN, 1TS, 1UN, 1XM, 1XX, 1YD, 1YK, 2AAB, 2AHK, 2AJR, 2AYV, 2BAK, 2BCR, 2BEA, 2BG, 2BJZ, 2BRC, 2WP, 2ZV, 3ARB, 3AF, 3AHK, 3AJD, 3AQR, 3ASV, 3CA, 3CC, 3DH, 3FS, 3GN, 3HG, 3KG, 3KM, 3TJ, 3XM, 3ZM, 3ZO, 3ZY, 3ZZ, 4AEX, 4BQ, 4BY, 4BZ, 4EU, 4GE, 4GL, 4RD, 4FV, 5UU, 8ADG, 8AGO, 8AGZ, 8ALD, 8AMD, 8AQF, 8AQV, 8AQY, 8AWP, 8AWY, 8AWZ, 8AXO, 8BEP, 8BK, 8BTP, 8BUM, 8CW, 8DR, 8EA, 8IV, 8JE, 8JS, 8JU, 8LG, 8LI, 8NI, 8OW, 8PX, 8QM, 8SP, 8VF, 8VV, 8XE, 8XM, 8XX, 8ZAC, 9AJH, 9AL, 9ALS, 9AMY, 9DR, 9DV, 9IO, 9MC, 9PQ, 9YK, 9ZJ.

### J. W. Robinson, Loudon, N. H.

Spark: 1AGO, 1ADP, 1AHD, 1AMQ, 1APO, 1APS, 1ASE, 1ANZ, 1AWO, 1AXI, 1BCA, 1BCF, 1BDT, 1BHR, 1BJS, 1BKG, 1BNM, 1BPF, 1BQA, 1BQL, 1BSR, 1BUV, 1BVR, 1BVR, 1BVS, 1YG, 1CHJ, 1CM, 1CNF, 1FB, 1FS, 1GW, 1HK, 1ON, 1RV, 1RX, 1SJ, 1WJ, 1YO, 2ADR, 2AER, 2AJD, 2AOM, 2ASL, 2AWF, 2BBN, 2BGD, 2BJP, 2BM, 2BRS, 2BXW, 2BY, 2CT, 2DN, 2FP, 2GV, 2JU, 2OO, 2QE, 2TJ, 3ACE, 3AJD, 3BFU, 3DM, 3FB, 3GN, 3PU, 4EA, 8AOT, 8BAC, 8BUM, 8BY, 8BQ, 8CCU, 8OD, 8WD, 8WE, 9AD, 9AF, 9AGR, 9UH.

C.W.: 1AFV, 1AVU, 1BDS, 1BKD, 1BUU, 1CAE, 1CP, 1CXU, 1DF, 1DH, 1WF, 2AVU, 2AWS, 2CCE, 2MB, 3AAO, 8AIO, 8AXN, 8BDH, XK1.

### 1BL, East Bridgewater, Mass.

C.W.: 1AB, 1AIP, 1AJR, 1AMS, 1ARY, 1AZD, 1AZW, 1BAZ, 1BCF, 1BCX, 1BDC, 1BDI, 1BEA, 1BES, 1BH, 1BIR, 1BKQ, 1BKR, 1BLA, 1BMY, 1BPE, 1BQE, 1BSD, 1BWJ, 1BYX, 1CAE, 1CAK, 1CDR, 1CKG, 1CKS, 1CIV, 1CLI, 1COD, 1FB, 1FF, 1JN, 1RH, 1TS, 1UN, 1XAD, 1XE, 1XM, 1XX, 1ZE, 2AAB, 2AAX, 2AB, 2ADV, 2AFV, 2AJF, 2AJW, 2ALR, 2AWF, 2BCF, 2BEA, 2BEB, 2BNZ, 2BTW, 2CDA, 2FD, 2KP, 2NZ, 2OF, 2OM, 2VA, 2VH, 3AAO, 3AAV, 3ADT, 3AJD, 3ANJ, 3APQ, 3BA, 3BE, 3CA, 3CG, 3KM, 3MO, 3ZO, 3ZY, 3ZZ, 4BY, 4EN, 4GL, 4GX, 8ADR, 8AHR, 8AMQ, 8AQQ, 8AQV, 8AQZ, 8AWP, 8AXC, 8BFX, 8BJV, 8BRC, 8FQ, 8HJ, 8HW, 8IB, 8IH, 8IQ, 8JU, 8LJ, 8NI, 8SP, 8UK, 8UY, 8VJ, 8YAC, 8ZG, 9AJH, 9AKR, 9HW, 9WC, Canadian 2BG, 9AW.

### 1BRQ, Lewiston, Me.

Spark: 1AAB, 1ABZ, 1ACO, 1ADP, 1AHL, 1AJS, 1AKG, (1APO), (1APT), 1ARY, 1ASF, 1AWS, 1AYR, 1AZK, 1BBK, 1BDR, 1BDT, (1BHR), 1BIR, (1BJE), 1BOQ, 1BQA, (1BQL), 1BVB, (1CCH), 1CHJ, (1CIB), 1CNF, 1COK, 1AP, 1AW, 1BA, 1CH, 1CK, 1CO, 1DH, 1DN, 1DZ, (1FM), 1FP, 1GM, 1HG, 1HO, 1IA, (1OE), 1OV, 1PV,

1QO, 1RV, 1SN, (1UL), 1XM, 1YB, 1YD, 1YX, 2ACW, 2AEP, 2AER, 2AJE, 2AJW, 2APE, 2ARB, 2ARK, 2ASK, 2ASL, 2ASM, 2ASR, 2AVK, 2AVU, 2AWP, 2BEA, 2BFU, 2BJO, 2AQ, 2AR, 2BF, 2BJ, 2BK, 2BL, 2BM, 2BQ, 2BY, 2CE, 2DH, 2IK, 2KM, 2OM, 2PU, 2PV, 2QY, 2RS, 2TA, 2TS, 2XQ, 2YF, 3AFK, 3AHF, 3AHK, 3AJD, 3AJE, 3AUW, 3AVK, 3AWT, 3AC, 3BT, 3FP, 3HJ, 3NC, 3OU, 3UC, 3UQ, 3VW, 3XM, 3XQ, 5RJ, 8AFB, 8AFG, 8AJI, 8AKO, 8AKQ, 8AOE, 8AOO, 8APB, 8APD, 8ARD, 8ASV, 8AXO, 8BEP, 8BRL, 8AG, 8AT, 8BE, 8CF, 8DN, 8FP, 8GC, 8HL, 8LQ, 8OE, 8PL, 8PT, 8QN, 8QM, 8SP, 8XE, 8YN, 8ZG, 9AVP, 9AQL, 9UP, 3GE.

C.W.: 1AFV, 1AMQ, 1ARW, 1ARY, 1AVR, 1AZW, (1BAS), 1BDC, 1BDI, 1BEA, 1BES, 1BKQ, (1BLJ), 1BQE, 1BSD, 1BTL, 1BUU, 1BWU, 1CAC, 1CGS, 1CIK, 1CJH, 1CKE, 1CLX, 1AQ, 1BE, 1CG, 1DF, 1FL, 1II, 1PT, 1QM, 1RD, 1RQ, 1TS, 1UN, 1VR, (1XM), 1YK, 1ZE, 2AAB, 2AAX, 2AJF, 2ALR, 2AWL, 2AYN, 2AYV, 2BBB, 2BGM, 2BJO, 2BRB, 2BYS, 2BG, 2FD, 2FP, 2NZ, 2OE, 2UD, 2VA, 2VH, 3ADT, 3ALE, 3ANJ, 3ASV, 3BL, 3DF, 3GO, 3HA, 3LE, 3MO, 3OM, 3RN, 3ZO, 4GL, 4TJ, 5GN, 8AIR, 8ALB, 8AMQ, 8AQF, 8AQV, 8AVM, 8BFX, 8BNQ, 8BUM, 8BXH, 8BZC, 8AC, 8AR, 8BK, 8BV, 8BX, 8DR, 8EW, 8HJ, 8IV, 8JS, 8NI, 8OU, 8OW, 8UK, 8VY, 8WC, 8WY, 8XE, 8XV, 9AJH, 9ALS, 9BV, 9PG, 9DWJ.

### 2AQU, Newark, N. J.

Spark: 1AMD, 1APO, 1ASF, 1AVI, 1AW, 1AZK, 1BQO, 1BRW, 1BVB, 1BVH, 1CK, 1COK, 1OJ, 1RV, 1WQ, 2AID, 2BM, 2SZ, 2XQ, 3AC, 3ACE, 3AGT, 3AHF, 3AHK, 3AJD, 3ALN, 3ARM, 3ARN, 3ATZ, 3AUW, 3BG, 3CI, (3CK), 3FP, 3GX, 3HJ, 3LP, 3NB, 3RV, 3RW, 3UC, 3UD, 3UX, 3XM, 3ZA, 4AU, 4BQ, 4CX, 4EA, 4EY, 4GN, 5EW, 5PY, 8AAV, 8AFA, 8AFB, 8AFG, 8AHS, 8AIB, 8AMB, 8APB, 8ARD, 8AXO, 8AYN, 8BEP, 8BFH, 8BRL, 8BUM, 8BZZ, 8FT, 8IN, 8KY, 8LH, 8LQ, 8NO, 8PT, 8SP, 8UC, 8VL, 8VQ, 8VW, 8WE, 8XE, 8YM, 8ZAC, 8ZP, 9AGR, 9AOE, 9AU, 9AZE, 9BP, 9CP, 9DKV, 9DWP, 9DYU, 9HK, 9LF, 9MC, 9OX, 9RC, 9TL, 9UH, 9UU, 9YB, 9YC, 9YQ, 9ZJ, Can.: 3BP, 3GE, 3GN, XGI.

C.W.: 1AA, 1AFV, 1AKB, 1ALP, 1ANQ, 1ARY, 1AVR, 1AZW, 1BDC, 1BDI, 1BES, 1BH, 1BIL, 1BIR, 1BKA, 1BKQ, 1BWJ, 1CAK, 1CEC, 1CGS, 1CY, 1FF, 1PM, 1PT, 1UN, 1XM, 1ZE, 2AAB, 2HI, 3AAD, 3AAD, 3AAO, 3ADT, 3AEV, 3AHK, 3AJD, 3ALE, 3ANJ, 3AQH, 3ARV, 3ASO, 3BKA, 3BLF, 3DH, 3HG, 3HJ, 3JH, 3MO, 3OT, 3QV, 3RW, 3SM, 3TJ, 3ZG, 3ZY, 3ZZ, 4BY, 4EH, 4EL, 4FT, 4ID, 4II, 4YA, 4ZE, 5FV, 5UU, 8AC, 8ADG, 8AFS, 8AGO, 8AGZ, 8AHR, 8AIO, 8AMB, 8AMK, 8AMQ, 8ANA, 8AND, 8ANR, 8AOP, 8AOO, 8AQF, 8AQH, (8AQV), 8BSB, 8ASV, 8AWP, 8AWY, 8AWZ, 8AXK, 8BBK, 8BDB, 8BEF, 8BEX, 8BFX, 8BK, 8BNT, 8BNZ, 8BO, 8BOX, 8BRL, 8BTO, 8BUM, 8BUQ, 8BYA, 8CHG, 8IQ, 8IV, 8JL, 8JQ, 8JS, 8LJ, 8LK, 8NI, 8OB, 8QB, 8SP, 8UJ, 8UK, 8VY, 8WA, 8XL, 8XV, 8ZG, 9AJH, 9AMB, 9ARK, 9BED, 9BIC, 9BLO, 9DV, 9DWJ, 9FM, 9HW, 9II, 9ZL, Can. 2BG.

### 2KV, Bronxville, N. Y.

Spark: 1APO, 1ARY, 1ASF, 1AW, 1AZK, 1BCO, 1CJH, 1ES, 1LZ, 1RY, 3AC, 3AGT, 3AHF, 3AJD, 3ALN, 3AUW, 3BHX, 3GN, 3HJ, 3IM, 3NB, 3OU, 3UD, 3UQ, 3UX, 3XM, 3ZM, 4AB, 4EA, 4CX, 5FJ, 5FV, 5XA, 7ER, 8AEC, 8ACF, 8AGO, 8AMB, 8APB, 8AYN, 8BBC, 8BHV, 8BRL, 8CAY, 8CZB, 8EV, 8EW, 8HJ, 8MZ, 8OI, 8PT, 8RC, 8SP, 8UC, 8VL, 8VQ, 8WU, 8YAA, 8YN, 8YM, 8ZAC, 8ZP, 8ZW, 9AFP, 9AIP, 9AMQ, 9ASJ, 9AWU, 9DCX, 9DYU, 9FT, 9GX, 9HR, 9OX, (9UH), 9UU, 9WT, 9YC, Can. 3BP, 3GE, 3GN, 3KG.

C.W.: (1AFV), 1AKB, 1ARY, 1AVR, 1AXB, 1AZW, (1BDI), 1BEA, 1BIR, (1BKQ), 1BSD, (1CAC), 1CJH, 1FF, 1FV, 1QN, 1XM, (1RD), 1RZ, 1ZE, (3ADT), (3AHK), 3AIS, 3ANJ, (3AQR), 3ASV, (3AWI), 3BAI, 3BZ, 3CA, 3CG, 3FS, (3HJ), 3LR, 3TJ, 3ZK, 3ZO, 3ZY, 3ZZ, 4AI, 4BQ, 4BY, 4GL, 4GX, 4ID, 4II, 4XC, 4ZF, 5KU, 5UU, (5ZAB), 6EN, 7MO, 8AGQ, 8AGZ, 8AIO, 8AML, 8ANZ, 8AOG, 8AQV, (8AWP), 8AWY, 8AXC, 8BBK, 8BFX, 8BK, 8BLT, 8BNW, 8BNI, 8BO, 8BQM, 8BRX, 8BZJ, 8DR, 8HJ, 8IQ, 8IV, (8JL), 8JQ,

8JS, 8KH, 8LX, 8NI, 8OC, 8OW, 8PX, 8QB, 8UJ, 8UK, 8UO, 8UY, 8VV, 8WR, (8XF), 8XH, 8XV, 8ZG, 8ZK, 8ZZ, 9AOJ, 9AAV, 9AJA, 9AL, 9ALP, 9ALR, 9AWP, 9DAU, 9DWJ, 9FM, 9NX, 9PG, Can. 9AW, 3BP.

### 2GK, Schenectady, N. Y.

Spark: 1ABB, 1AEV, 1ALK, 1APO, 1ARY, 1ASF, 1ASR, 1AW, (1AZK), 1AZW, 1BCF, 1BDM, (1BEA), 1BKA, 1BQO, (1BUA), 1BVB, 1DY, 1FU, (1GM), (1IA), 1RU, 1RV, 1SN, 1WQ, 1YD, (2ABM), 2AER, (2AIJ), 2AIM, 2AQI, 2AR, 2ASL, 2AZY, 2BAK, 2BIR, 2BJO, 2BJP, (2BK), (2BM), 2BXZ, 2DA, 2DN, (2DO), 2DR, 2DX, 2EL, 2FP, 2IQ, 2JU, (2JZ), (2LX), 2MJ, (2OM), (2OO), 2RF), 2QR, 2TS, 2UD, 2UK, 2WB, 2WM, 2XK, 3AC, 3ACM, 3ACS, 3AGT, (3AHF), 3AHK, 3AIG, 3AIW, 3AJ, 3AJD, 3ALN, 3AQR, (3ARM), (3ARN), 3ASH, 3AUP, (3UW), 3BA, 3BFU, (3BG), (3BGT), 3BJB, 3CE, (3CN), 3FB, (3FQ), 3EM, 3GN, 3GX, (3HJ), 3IW, 3JO, 3KT, 3LI, 3LM, (3OU), 3PB, 3PU, 3QB, (3QP), 3RW, 3SQ, 3UC, (3UQ), 3VW, 3XM, (3ZA), 3ZO, 3ZV, 3ZZ, Can. 3BP, (3GE), 4CX, (4EA), 4FD, 4FP, 4GN, 5FV, 6ZA, 8AAV, 8ACF, 8AEC, 8AFA, 8AFB, 8AGB, 8AHH, 8AHS, 8AJT, 8AKQ, (8AMZ), 8ANO, (8AOT), 8APB, 8AQV, (8ARD), 8AUE, 8AV, 8AVD, (8AVT), 8AWP, 8AXO, 8AXN, 8AXX, 8AYN, 8AYS, 8AZV, 8BCO, 8BDY, 8BET, 8BEP, 8BHV, 8BGT, 8BM, 8BOK, 8BPY, 8BRL, (8BUN), 8BVA, 8CAK, 8CD, 8CI, 8OP, 8EB, 8WE, 8JJE, 8JJ, 8JL, (8MJ), 8MR, 8MZ, 8NO, 8OH, 8QN, 8SP, (8TJ), 8TK, 8TT, (8VW), 8WD, (8WE), 8WO, 8WZ, 8XE, 8XM, 8XR, 8YAA, 8YN, 8ZAC, 9AAP, 9AAW, 9AC, 9AGR, 9AIJ, 9AZE, 9BER, 9AJE, 9ANZ, 9AVP, 9DLX, 9DWJ, 9DWJ, 9DWP, 9FM, 9HM, 9IO, 9ME, 9MH, 9OX, 9TL, 9UH, 9UL, 9XF, 9ZJ, 9ZN.

C.W.: 1AFV, 1BCG, (1BEA), (1BUA), (1CAK), 1UN, (1XM), 1ZE, 2AAB, 2AAX, 2ABZ, 2AJF, 2AJW, 2AWL, 2AYS, 2BAK, (2BML), 2BRK, 2CCL, (2EH), 2FD, 2FP, 2KL, 2OM, 2XB, 3AAN, 3DH, 3HG, 3IH, 3ZG, 4EL, 4GL, 8ADG, 8ADN, 8AGZ, 8AIL, 8AMN, 8AUA, (8APH), 8AQV, 8AWP, 8BA, 8BAD, 8BBK, 8BOM, 8CF, 8BMA, 8IQ, 8JL, (8TB), 8UJ, 8XK, 8XV, 8ZV, 9ARK, 9AW, Can. 9AL.

### 3AFU, Washington, D. C.

C.W.: 1QD, 1QN, 1ZE, 1AFV, 1ANQ, 1AQW, 1ARY, 1AXD, 1AZW, 1BDI, 1BEA, 1BIR, 1BKQ, 1BSD, 2LO, 2NQ, 2TP, 2WI, 2ZE, 2ALV, 2AWF, 2AVY, 2BAK, 2BCF, 2BEA, 2BEB, 2BES, 2ZGH, 2BGM, 2BRB, 2BYS, 3BG, 3CG, (3EM), (3FQ), 3FS, 3GH, 3HG, 3JY, 3MA, 3RL, (3SK), (3SQ), 3SS, 3TJ, 3ZN, 3ZO, 3ADT, (3AHK), 3AJE, 3AJD, 3AQR, 3AWF, 2EC, 3BLF, 4BY, 4EH, 4GL, (4GX), 4HW, 4LE, 5AN, 5FV, 5GV, 5KU, 5NZ, 5UU, 8AR, 8BK, 8BO, 8DR, 8EB, 8GV, 8HJ, 8IH, 8IQ, 8IV, 8JL, 8JQ, 8JU, (8LJ), 8NI, 8OS, 8OW, (8PN), 8PX, 8SE, (8SP), (8UK), 8VJ, 8VY, 8XV, 8ZG, 8ADG, 8AGG, 8AGO, 8AGZ, 8AHR, 8AIF, 8AIO, 8ALB, 8AOA, 8AOG, 8AOO, 8AQC, (8AQV), 8ASV, 8AUO, 8AWP, (8AWZ), 8AXC, 8BBW, 8BCA, 8BCI, 8BEF, 8BEX, 8BFX, 8BLT, 8BNJ, 8BOX, 8BUM, 8BWZ, 8BXA, 8BZJ, 8CFP, 8ZAE, 8CP, 9DV, 9HW, 9II, 9IO, 9IZ, 9KR, 9NZ, 9PG, 9SJ, 9WC, 9ZY, 9AAS, 9AAU, 9AAV, 9AJA, 9AJH, 9AKH, 9ALS, 9ANF, 9AOS, 9ARK, 9BBF, 9BDW, 9BED, 9BLO, 9DCR, 9DDW, 9DWJ.

Spark: 2JU, 2OM, (2AHU), 2ASJ, (3AC), 4XC, 5ZL, 5XA, 5XU, 8PT, (8RQ), 8XE, 8AFD, 8AHH, 8AIZ, 8AJT, 8APB, 8ARD, (8AXY), 8BEP, 8BQC, 8BRL, 8YAC, 8ZAC, 9CP, 9YM, 9ACN, 9ACY, 9AEK, 9AFP, 9AIR, 9AMK, 9AOE, 9AVP, 9DYF.

### 3CA, Roanoke, Va.

C.W.: 1ARY, (1BDI), 1BEA, 1BFQ, 1BII, 1BKQ, 1BRZ, 1QN, 1ZE, 2AB, 2AAB, 2ADV, 2AJR, 2AKO, 2AYV, 2BEB, 2BNZ, 2BRG, 2CCD, 2OM, 2VH, 2WP, 8AAE, (8AEV), 3AFU, 3AHK, 3ANQ, 3AQR, 3BLF, 3BG, (3BP), (3BZ), 3CC, 3FS, 3HG, 3HJ, 3HX, 3IO, 3KM, 3LR, 3MO, (3OT), 3RW, 3TH, 3TJ, 3WP, 3XAA, 3XC, 3ZN, (3ZY), 3ZZ, (4BK), 4BQ, (4BY), 4CY, 4EB, 4EL, 4FT, 4GL, 4GN, 4IL, (4XD), 4XM, 4ZE, 5DZ, 5EK, (5FV), 5OS, 5UU, 5XJ, 8ADG, 8AFS, 8AGZ, 8ALB, 8APH, 8APN, 8APT, 8AQH, 8AQF, 8AQO, 8AQV, 8AQZ, 8ARW, (8AWY), 8AWZ, 8AXC, 8AXO, 8BCR,

8BEP, 8BEX, 8BFX, 8BFG, 8BLT, 8BOF, 8BOX, 8IQ, 8IV, 8JS, (8SP), (8XE), 8XO, 8XV, 8YAC, 8ZA, 8XAE, 8ZQ, 8ZV, 8ZZ, 9AAS, 9AAV, 9AIF, 9AKD, (9AKR), (9AWR), 9AYS, 9BED, 9CAB, 9DKP, 9FM, 9HK, 9IL, 9IL, 9IO, 9IZ, 9KX, 9NX, 9ZL, Canadian 2BG, 3BP, 9AL.

Spark: 3AAA, 3AAB, 3ALN, 3ARB, 3CN, 3KM, 3XM, 3ZAA, 3ZV, 4EA, 4CG, 4GG, 5KK, 5XB, 5ZL, 8AIR, 8AYP, 8BEP, 8BNP, 8CP, 8DCX, 8FI, (8XE), 8YM, 8ZA, 9ABH, 9AIU, 9DF, 9DCX, 9FS, 9PB, 9VL, 9YC.

### 3KK, Wilmington, Del.

Spark: 1AV, 1AEV, 1ALK, 1APX, 1BC, 1DZ, 1FR, 1NC, 1TK, 1WQ, 2BK, 2EL, 2FR, 3CD, 3HJ, 3BG, 3BK, 3RW, 4AG, 4GN, 5KU, 5XA, 5AC, 8AFD, 8AJK, 8AOB, 8APB, 8BM, 8CAY, 8LQ, 8XE, 9DF, 9DDQ, 9DP, 9OE, 9OX, 9UH, 9YC, 9ZN.

C.W.: 1AF, 1AFV, 1AEV, 1ARY, 1ANQ, 1APX, 1ARD, 1ALK, 1AZW, 1BEA, 1BDC, 1BLK, 1BDI, 1BKQ, 1BTE, 1BD, 1BW, 1EZ, 1FF, 1FR, 1FA, 1GV, 1LR, 1NC, 1PM, 1QN, 1RK, 1US, 1UN, 1XM, 1ZE, 2AA, 2AAB, 2AAC, 2AK, 2AJF, 2AWI, 2AYV, 2BV, 2BCG, 2BFZ, 2BGH, 2BRZ, 2CAM, 2CEC, 2CT, 2FD, 2HI, 2KV, 2NS, 2RF, 2VI, 2XK, 3ADT, 3AQF, 3AAF, 3AFB, 3AQU, 3AH, 3AJB, 3AR, 3ATW, 3ANJ, 3AAD, 3AAE, 3AAN, 3AEV, 3AQH, 3BC, 3BZ, 3BCI, 3BFQ, 3BO, 3BBR, 3BMJ, 3CC, 3CA, 3DC, 3FS, 3GR, 3HJ, 3IF, 3KM, 3LO, 3LR, 3MC, 3QN, 3PR, 3OT, 3SH, 3TJ, 3ZV, 3ZY, 3ZZ, 4AA, 4AS, 4BQ, 4BY, 4CY, 4DC, 4EL, 4ET, 4FD, 4GL, 4GX, 4ID, 4II, 4KC, 4LE, 4TR, 4UF, 5FV, 5GU, 5UU, 5AAM, 5ABG, 5AHR, 5AQV, 5AVH, 5AGO, 5AMK, 5AWY, 5AZF, 5BO, 5BQ, 5BK, 5BRF, 5BFR, 5BFX, 5BOX, 5BRL, 5BJZ, 5CL, 5CAY, 5DR, 5ET, 5GV, 5IV, 5JL, 5JS, 5LO, 5LX, 5OC, 5OW, 5SP, 5TC, 5UJ, 5UF, 5WD, 5VY, 5ZG, 9AY, 9AJH, 9AAV, 9BBF, 9BED, 9BSD, 9DWJ, 9ZO, 9ZY.

### 3YV, University, Va. \*

1ARV, 1GN, 1ZE, 2AAB, 2BJ, 2BM, 2BWE, 2OM, 2XI, 2XJ, 3AC, 3ADT, 3AFK, 3AGR, 3AHK, 3BAB, (3BHL), 3CC, 3FM, 3GN, 3HA, 3HJ, 3HO, 3JW, 3JT, 3RF, 3SF, 3ZO, 3ZY, 4GL, 4BQ, 5FM, 5NZ, 8AAV, 8ABV, (8FG), 8AFD, 8AGZ, 8AGO, 8AHR, 8IM, 8AJT, 8AJA, 8AKW, 8ARD, 8ASE, (8AUC), 8AXC, 8BFX, 8BK, 8BOX, 8BRL, (8BWI), 8BZZ, 8CBR, 8DZ, 8EA, (8HJ), 8IH, 8IV, 8NI, 8SP, 8UC, 8XV, 8YN, 8ZAA, 9AJA, 9CA, 9CMN, 9DHZ, 9DKV, (9UU).

### 4GE, Savannah, Ga.

Spark: 2XM, 3XM, 4AS, 4AH, 4BC, 4CX, 4DZ, 4YA, 4GU, (4ZC), 5DA, 5BC, 5XA, 5XB, 5NH, 5XU, 5ZL, 5ZZ, 5YL, 5ZAB, 5AFB, 5AFD, 5BEP, 5CP, 5UC, 8YAA, 9ACL, 9AMS, 9AMQ, 9AMK, 9DQC, 9MC, 9OX, 9ME, 9YC, 9YM.

C.W.: 1ARY, 1AZW, 1FF, 2AAX, 2BEB, 2NZ, 2WP, 3BZ, 3BL, 3CA, 3CG, 3HG, 3RF, 3ZD, 4AS, 4BQ, 4BK, 4CO, 4CY, 4EN, 4EH, 4GX, 4ID, 4II, 4ZE, 5EK, 5LA, 5NZ, 5KU, 5UU, 5AGL, 5ALB, 5AQV, 5AOA, 5AXC, 5AWZ, 5BEX, 5BFX, 5BK, 5DR, 8IQ, 8JU, 8HJ, 8JP, 9AAV, 9AAS, 9BIG, 9BIK, 9AKD, 9BLO, 9DKI, 9NX, 9ZB, 9ZY.

### 4HJ, South Jacksonville, Fla.

Spark: 2FP, 2OM, 3AHK, 3BG, 3FB, 3XM, 4AG, 4AS, 4AX, 4BC, 4BQ, 4BY, 4CG, 4CP, 4CX, 4DH, 4DZ, 4EA, 4FB, 4GH, 4GN, 4GU, 4HS, 5AA, 5BC, 5BY, 5DA, 5EW, 5FJ, 5FO, 5GI, 5HK, 5IS, 5KD, 5NH, 5XA, 5XB, 5XK, 5XU, 5YL, 5YM, 5ZA, 5ZL, 5ZX, 5ZZ, 8ACF, 8HP, 8LQ, 8UC, 8XE, 8YM, 8ZP, 9AEK, 9APS, 9DCX, 9DHz, 9DQ, 9LF, 9MC, 9PS, 9UU, 9YC, 9YM, 9ZJ.

C.W.: 1IV, 1UN, 1XM, 2AAB, 2FS, 3AAY, 3AHK, 3AQR, 3AWW, 3BJ, 3BL, 3BL, 3CA, 3CC, 3MO, 3RF, 3ZY, 4AS, 4BK, 4BQ, 4BY, 4EH, 4EL, 4EN, 4FF, 4FR, 4FL, 4GL, 4HW, 4II, 4ID, 4ZF, 5FV, 5KU, 5LA, 5UU, 5AGO, 5AGZ, 5AIO, 5ALV, 5AXC, 5AQF, 5AVV, 5BFX, 5BK, 5BRL, 5DR, 5II, 8IQ, 8IV, 8JJ, 8JP, 8SP, 8VJ, 8ZA, 9AAS, 9AJA, 9AKR, 9AMB, 9ARK, 9BBF, 9BLO, 9DKI, 9FG, 9SJ, 9ZB.

### 4AB, Wilmington, N. C.

1DF, 1DY, 1XK, 1XM, 1SD, 1AEV, 1AFV, 1ARY, 1BEA, 1BJE, 1BCF, 1BRW, 2BJ, 2BK, 2CF, 2EL,

2FP, 2OM, 2OO, 2PU, 2TJ, 2WB, 2XJ, 2XM, 2AAB, 2ACE, 2AER, 2ARB, 2AWK, 2DRK, 3AH, 3BG, 3DG, 3DH, 3FS, 3IE, 3MO, 3PB, 3PD, 3PU, 3QN, 3QW, 3SQ, 3UD, 3UH, 3US, 3XC, 3XM, 3AGB, 3AGT, 3AHK, 3AQK, 3AQR, 3BFN, 3BFV, 4AS, 4BC, 4BI, 4BX, 4BY, 4CX, 4EA, 4EY, 4DZ, 4GL, 4GN, 4GS, 4GU, 4HS, 4XB, 5DA, 5FO, 5FV, 5KA, 5ZA, 5ZS, 5XA, 5BA, 5BR, 5BT, 5BX, 5EW, 5FB, 5FT, 5JS, 5IQ, 5ML, 5OI, 5SP, 5UC, 5VN, 5XE, 5ZA, 5ZL, 5ACF, 5AFD, 5AFT, 5AHS, 5ANW, 5APB, 5ARB, 5AWY, 5BSY, 5BYE, 5BVL, 5AF, 5DR, 5IC, 5LQ, 5LF, 5MC, 5MO, 5UL, 5ACZ, 5AGR, 5BED, 5DCX, 5DWP, 5DWU.

### 5AX, Birmingham, Ala.

Spark: 5DA, 5DF, 5FV, 5GI, 5LO, 5UP, 5XA, 5XB, 5XU, 5YL, 5ZA, 5ZW, 5ZZ, 8YAF, 8YM, 8XE, 9AY, 9ME, 9NR, 9YA, 9YB, 9YC, 9YM.

C.W.: 4BY, 4BZ, 4CY, 4EB, 4EL, 4EL, 4II, 4LT, 4XB, 4ZF, 4ZO, 5KA, 5KP, 5NZ, 5XJ, 5XP, 5NZ, 5XJ, 5XP, 5ZAB, 5ZAC, 7BR, 8AU, 8BRK, 8BRF, 8XK, 8ZG, 8ZZ, 9AKR, 9AL, 9AOF, 9AVN, 9AS, 9BIK, 9BL, 9DFI, 9BRM, 9HK, 9II, 9KA, 9TV.

### 5KC, Plaquemine, La.

1BCG, 2FP, 2QR, 2AK, 4AS, 4BQ, 4CG, 4CO, 4CS, 4CX, (4DH), 4GL, 4ID, 4II, 4LE, 4TQ, 4ZF, 5AE, 5AL, 5AN, 5BI, 5BN, 5BQ, 5BX, 5BY, 5DA, 5DW, 5ED, (5EK), 5EW, 5FO, 5FV, (5HK), 5HZ, 5IC, 5IR, (5JD), 5JL, 5JR, 5KK, 5KP, 5LB, 5LO, 5MT, 5MY, 5NK, 5NS, 5QS, 5RA, 5RL, (5SM), 5TG, 5TP, 5UG, 5UJ, (5XA), 5XB, 5XI, (5XJ), 5XL, 5XQ, 5XT, (5XU), 5YA, 5YB, 5YE, 5YK, 5YM, 5YN, 5ZA, 5ZB, 5ZC, 5ZE, (5ZL), 5ZO, 5ZR, 5ZS, 5ZT, 5ZU, 5ZV, (5ZW), 5ZX, (5ZZ), 5ZAF, 5ZAL, (5ZAK), 5ZAN, 5ZAX, 5AIF, 5AA, 5AJ, 5VJ, 8XI, 8XM, 8YM, 8ZU, 8BOX, 8ZAC, 9AC, 9AK, 9AP, 9AY, 9DW, 9ET, 9FM, 9FU, 9FY, 9FZ, 9GN, 9HI, 9HM, 9HR, 9HT, 9IV, 9JN, 9JQ, 9JX, 9KF, 9KO, 9LO, 9MC, 9NR, 9OX, 9PG, 9PS, 9QJ, 9RR, 9TQ, 9TV, 9UG, 9VL, 9WI, 9WJ, 9WT, 9WU, 9XI, 9XJ, 9XM, 9YA, 9YB, 9YC, 9YK, 9YM, 9YO, 9YR, 9ZF, 9ZH, 9ZJ, 9ZN, 9AAP, 9ACB, 9AEG, 9AEK, 9AEY, 9AIG, 9AMA, 9AMK, 9AMO, 9AMR, 9AMS, 9ANF, 9AOJ, 9AOU, 9AVD, (9AQE), 9AQM, 9AEX, 9AIN, 9AVC, 9AVE, 9AVK, 9AVP, (9AXU), 9AYK, 9AZA, 9BBF, (9DEH), 9DHz, 9DQ, (9DSD), 9DWJ, (9YAE), 9YAK, 9ZAC.

C.W.: 2ZL, 4BQ, 4BY, 4EB, 4EL, 5BL, 5XB, 5YI, 5ZA, 8XB, 8XY, 8ZG, 8BFX, 9AO, 9AR, 9FM, 9HK, 9JD, 9LQ, 9LZ, (9NX), 9XI, 9XM, 9XR, 9ZY, 9AAS, 9AAV, 9ACO, 9AKR, 9AVN.

### 5PO, Houston, Texas

1ARJ, 1TS, 2FT, 2VP, 3CA, 3ZD, 4BK, 4BY, 4CY, 4DY, 4EL, 4F, 4GL, 4GU, 4ID, 4II, 4XC, 5BC, 5BY, 5FO, 5HK, 5IF, 5JD, 5JP, 5KU, 5LA, 5LB, 5LO, 5MT, 5NC, 5OI, 5UG, 5ZAB, 5ZA, 5ZAK, 5ZL, 5ZU, 5XA, 5XU, 6TV, 6ZZ, 7RD, 7ZA, 8CFP, 8DFX, 8ED, 8BOX, 8GR, 8IV, 8ZL, 9AAZ, 9ARK, 9AKR, 9AKV, 9ABV, 9AC, 9AIF, 9AMA, 9AJA, 9HM, 9AYS, 9AWX, 9ACB, 9AUX, 9BBF, 9BIG, 9XI, 9XM, 9XAK, 9NX, 9DFX, 9DVA.

### 5DA, Wind Rock, Tenn.

Spark: 1AW, 1AEV, 2AJE, 2BK, 2OM, 2WB, 3AOV, 3XF, 3XM, 3YO, 3ZO, 3BP Can., 4AS, 4AU, 4BI, 4BQ, 4BX, 4CP, 4CX, 4DH, 4DZ, 4EY, 4FB, 4FD, 4GG, 4GH, 4GN, 4GU, 4GX, 4HS, 4YA, 4YB, 4XC, 5AA, 5AI, 5BM, 5BY, 5EK, 5ER, 5FJ, 5FO, 5GI, 5HK, 5IH, 5JD, 5JI, 5JO, 5PH, 5PY, 5UG, 5UJ, 5XA, 5XB, 5XC, 5XJ, 5XK, 5XU, 5YL, 5YM, 5ZA, 5ZAB, 5ZAA, 5ZD, 5ZL, 5ZS, 5ZD, 5ACF, 5AFD, 5AFG, 5AL, 5AYN, 5BDN, 5BEP, 5EF, 5JS, 5LA, 5SP, 5TK, 5UC, 5UD, 5WZ, 5XE, 5YAA, 5ZA, 5ZJ, 9AAU, 9AEG, 9AEK, 9AGH, 9AGR, 9AIR, 9AJA, 9AJN, 9ALC, 9AMS, 9AMU, 9ANO, 9AOJ, 9APB, 9APS, 9AQN, 9ARG, 9ARZ, 9ASE, 9AWE, 9AYW, 9AYY, 9AZA, 9BEE, 9DCX, 9DHD, 9DHz, 9DKV, 9DQ, 9DQU, 9DYC, 9DYU, 9DZI, 9DZE, 9DZK, 9EK, 9FM, 9GS, 9GX, 9HG, 9HI, 9HP, 9HR, 9JN, 9QJ, 9MC, 9MH, 9OU, 9OX, 9PT, 9PW, 9TU, 9UU, 9UH, 9VZ, 9WT, 9YA, 9YAK, 9YB, 9YC, 9YM.

C.W.: 1AAH, 1ARY, 1BKQ, 2BEB, 2BUL, 2WP, 2TW, 3AHK, 3AWI, 3BEC, 4BK, 3BQ, 3BZ, 3CA,

C.W.: 5AK, 5ZA, 6AIF, 6AK, 6ALE, 6ASV, 6AWV, (6GY), (6PT), 6VM, (6XAD), 6XAF, 6XH, 6ZA, (6ZB), 6ZZ, 7XF, 8XV, 9AMB, 9BJI, 9DB, 9DTM, 9DVA, 9JI, 9NX, 9WD, 9XAQ, Can. 9BD, NOF, CL8.

5FO, 5HK, 5IF, 5XJ 5XU, 5ZA, 5ZZ (6AAH)  
 (6AAU), 6AAT, 6ABX, (6ACR), 6AEH, 6AFN  
 (6AFP), 6AGE, 6AGU, (6AHQ), 6ATF, (6AJW)  
 (6AKI), 6AKT, (6ALE), 6AMK, 6APE, 6APP  
 (6ARU), (6ATF), (6ATQ), (6BAF), (6CK), 6CV  
 6EB, (6FK), 6HT, (6IV), 6JY, 6KC, 6LA, 6LC  
 6LU, 6MH, 6PR, (6RS), 6SJ, 6TF, 6TO, 6TU  
 (6TV), 6VB, (6VM), (6VZ), 6WV, 6XH, 6ZA  
 (6ZAM), 6ZAL, 6ZK, (6ZR), (6ZX), 6ZZ, (7BJ)  
 7CK, (7HM), (7HF), 7LA, (7LN), 7LO, 7LY  
 7MA, 7MF, (7MP), 7MU, 7NK, (7NZ), 7OT, 7PS  
 (7SB), (7VO), 7VZ, 7YA, 7ZG, 7ZN, (7ZO), 7ZS  
 7ZU, 7ZV, 9AIG, (9AMB), 9ANF, 9AVR, 9AVU  
 9AYS, 9BDF, 9BJ, 9DCI, 9DKS, 9DOC, 9EY, 9FI,  
 (9XAQ), 9YAE, 9YAK.

Spark: 5XU, (5ZA), 5ZZ, 6AAH, (6AAU), (6ABW), 6ABX, 6ACK, 6ADA, 6ADL, (6AEH), 6AFN, (6AGF), 6AGP, (6AH), 6AHP, 6AIV, 6AIB, 6AIO, 6AJR, 6AK, (6AKL), (6ALP), 6ALV, 6AMK, (6ANG), 6AOR, 6APP, 6ARK, (6AS), 6ATH, 6ATQ, (6ATV), 6AV, 6ABA, 6AVV, 6AWH, 6AWT, 6AWX, 6BAJ, 6BAK, 6BAZ, 6BCJ, (6BGH), 6BM, 6CV, (6EA), 6EB, 6EN, (6EX), 6FH, (6FK), (6FT), 6GF, 6GT, 6GX, 6IB, 6IS, 6IV, (6KC), (6LC), 6NG, (6MH), (6OD), 6OH, 6PJ, (6PO), 6PR, (6QR), 6SJ, 6ST, 6SU, 6TO, (6TU), (6TV), 6UO, 6VK, (6VX), (6WH), 6WR, 6WZ, 6ZAA, 6ZAL, (6ZAM), 6ZD, 6ZK, 6ZU, (6ZX), (6ZZ), 7BH, 7BJ, 7BK, 7BR, 7CK, 7FI, 7FQ, 7GJ, 7HF, 7IW, 7LO, 7MF, 7MH, 7MP, (7MY), 7TJ, 7VO, 7YA, 7YG, 7YL, 7ZJ, 7ZM, 7ZT, 7ZU, 7ZV, 8ZP, Canadian 9AX, 9BD, 9YAE, 9YAL.

Spark: 5MJ, 5XU, 6AAH, 6AAU, 6ABH, 6ABW,  
6ABX, 6ACL, 6ACR, 6ADA, 6AEH, 6AFN, 6AFP,  
6AGF, 6AH, 6AIF, 6AIN, 6AJF, 6AJR, 6AKL,  
6ALV, 6AMK, 6ANG, 6ANH, 6AOR, 6APP, 6ARK,  
6AS, 6ASK, 6ATH, 6AUC, 6AUD, 6AVB, 6BCA,

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**7ZJ, Vancouver, Wash.**

Spark: 51R, 5JL, 5QA, 5YQ, 5ZA, 5ZAA, 5ZAK, 5ZAM, (5XB), (5XU), (6ABW), 6ACR, (6AFN), (6AGF), 6AHP, 6AIX, 6AMK, (6ANG), 6AOR, (6AS), 6ATV, 6ATH, (6AVB), 6AWT, 6BGH, 6EA, 6EB, 6EK, (6EX), 6LC, 6NG, 6PR, 6QR, 6QB, 6UO, 6VX, 6ZAM, 6ZAE, (6ZK), 6ZR, (6ZU), (6ZX), 7AAO, 7BA, 7BC, 7BH, (7BK), 7CK, (7FI), 7GE, 7GO, 7HF, 7HM, 7JD, 7KN, (7MF), 7MP, 7NN, (7NL), 7NZ, 7RY, 7TJ, (7YA), (7YL), (7YJ), (7YS), (7ZM), 7ZO, (7ZP), 7ZS, (7ZU), 9DKV, 9DZE, (9WU), (9YAE), (9YAK), 9ZX, Can. 5AK, 9AX, 9BD.

**7TQ, Medford Oregon**

Spark: 6AC, 6CV, 6EA, 6FH, 6GT, 6IV, 6LA, 6LK, 6KM, 6NG, 6OH, 6OL, 6PJ, 6QR, 6TO, 6TU, 6TV, 6UC, 6UO, 6UZ, 6VC, 6VH, 6VX, 6WR, 6ZK, 6ZX, (6ABW), 6AAU, 6AEI, 6AGP, 6ALA, 6ALW, 6ALX, 6AMK, 6ANI, 6ANR, 6APP, 6ARD, 6ARK, 6ATN, 6ATV, 6ACV, 6ANP, 6AVB, 6AVR, 6BBR, 7BA, 7BH, 7BC, 7BC, 7BZ, 7CD, 7CK, 7CV, 7GE, 7HF, 7HI, 7HM, 7IY, 7LY, 7KB, 7MF, 7MK, 7MY, 7NN, 7NW, (7OH), 7OM, 7OY, 7OO, 7TJ, 7WA, 7YA, 7YG, 7YL, 7ZJ, 7ZM, 7ZP, 7ZT, 7ZV, Canadian 9AX, 9BD.

C.W.: 5AK, 6EN, 6AD, 6JO, 6KA, 6PD, 6QA, 6NI, 6WV, 6XH, 6AAK, 6AAT, 6ALE, 6ALU, 6ATG, 6ASJ, 6ZAF, 7CS, 7MA, 7NX, 7RN, 7XF, 9ZAF.

**7VZ, Libby, Mont.**

Spark: 5IF, 5ZA, 5AK, 5EA, 5ER, 5HC, 5KP, 5LC, 5MH, 5OD, 5PR, 5QR, 5TO, 5TU, 5TV, 5VX, 5WZ, 5XH, 5ZU, 5ZX, 5ZZ, 5ZAM, 6AAH, 6AAK, 6AAU, 6ABW, 6ABX, 6AEZ, 6AFN, 6AFY, 6AGF, 6AHP, 6AIF, 6ALP, 6AMK, 6ANG, 6APE, 6ATQ, 6AVV, (7BA), 7BH, (7BJ), (7BK), 7BP, (7BR), 7BZ, 7CW, 7DG, (7DK), (7FI), 7FL, (7GE), 7HI, 7IN, (7IW), 7IY, 7JD, (7JV), 7KB, 7KE, (7LN), (7LU), (7LY), 7MF, (7MP), (7MU), 7NG, (7NL), (7NN), (7ON), (7OT), 7PO, 7RN, 7TV, 7VO, 7WA, 7XB, 7YA, 7YS, 7ZB, 7ZU, (7ZT), 7ZU, 7ZY, 7AAI, 9AB, 9DK, 9DU, 9HM, 9RY, 9AEG, 9AGN, 9AIF, 9AIG, 9DOC, 9DOX, Canadian 9AX, 9BD, 5AK, 5BF, 5FI.

C.W.: 4CB, 6XG, 6ALE, 6AQT, 7UD, 9AMB, 9XAG.

**Kent Burson, Tekoa, Washington**

Spark: 6ABX, 6ACF, 6ACR, 6AFN, 6AGF, 6ARD, 6ARK, 6ATZ, 6ATH, 6ATQ, 6CV, 6EB, 6GF, 6IR, 6LD, 6LF, 6LU, 6PO, 6QR, 6TU, 6UO, 6ZAM, 6ZK, 6ZJ, 6ZB, 6ZM, 6ZX, 7BA, 7BC, 7BF, 7BK, 7BJ, 7CC, 7CD, 7CK, 7EY, 7JF, 7FQ, 7GB, 7GJ, 7HF, 7HM, 7IN, 7IY, 7JD, 7JF, 7IW, 7KB, 7KS, 7KG, 7KJ, 7LA, 7LY, 7MP, 7MU, 7NF, 7NL, 7NN, 7RK, 7TJ, 7UO, 7VM, 7MH, 7XA, 7XS, 7YA, 7YL, 7YN, 7YW, 7YJ, 7ZA, 7ZM, 7ZP, 7ZO, 7ZT, 7ZJ, 7ZU, 9AGN, 9BD, 9LW, 9PL, 9WU, 9YA, 9YAK, CLS.

C.W.: 5TS, 6ALE, 6AIF, 6ALU, 6ATG, 6ATQ, 6AUL, 6AWP, 6AWT, 6AWE, 6EN, 6KA, 6IW, 6KU, 6KY, 6LA, 6LR, 6PD, 6VC, 6WV, 6XAD, 6XAF, 6XM, 6ZA, 6ZB, 6ZT, 7CS, 7DA, 7KA, 7MA, 7OG, 7RN, 7SC, 7TQ, 7TH, 7UZ, 7UX, 7ZF, CLS, 8AB, 9AYS, 9BBF, 9BD, 9BIK, 9BJI, 9DB, 9DCF, 9DTM, 9DUO, 9DVA, 9DVK, 9FO, 9JL, 9NX, 9WD, 9WU, 9XAG, 9ZAF.

**8CP, Holland, Mich.**

(2ARB), 2ARM, 2BFU, (2BM), 2BK, 2EL, (2FP), 2OM, 2PU, (2JU), 3AJD, 3BK, (3FB), 4CG, 4CX, 4DH, 4BQ, 4GN, 5BY, 5ER, (5FO), 5HK, 5IQ, 5IS, 5PG, 5TU, 5ZA, 5ZL, 5AAP, 8ACF, (8ACO), (8AFA), (8AFV), 8AFG, (8AIE), 8AIZ, (8AJK), (8AKQ), 8AKV, (8AMZ), 8ANO, 8AOG, 8ARD, 8ARS, 8ATU, (8AUM), (8AUV), (8AVE), (8AVT), (8AXN), 8AXO, 8AYN, (8BAZ), (8BBU), (8BCY), 8BEP, (8BEN), 8BHV, (8BLW), 8BUM, (8BTL), 8BWD, (8BXC), 8BXX, (8ZAA), 8ZAC, 8BA, 8CH, (8EB), 8EF, 8EW, 8FI, 8FT, (8JP), (8JJ), (8NZ), 8OL, 8QQ, (8SP), (8UC), (8YN), (8VY), (8XE), (8WD), 9AAP, 9AAW, 9ACB, 9ACL, (9AEF), 9AEZ, 9AFF, (9AGR), (9AGN), 9AIF, 9AIR, (9AIU), (9AJH), (9ALP), (9ALU), 9AMK, 9AMQ, (9ANO), (9AOH), (9AOJ), 9APK, (9ARZ), (9ASJ), (9ASK), (9AUH), 9AUL,

9AVP, (9AWZ), 9AYH, 9AZA, (9AZE), (9BDS), 9BIJ, (9DAZ), (9DBU), (9DGV), 9DHD, (9DHz), (9DKQ), (9DRV), (9DLX), 9DLW, 9DMM, 9DQO, (9DRA), 9DSO, 9DSO, 9DTN, 9DYU, 9DYW, 9DXM, 9DXW, 9DYY, 9DZE, 9DZI, 9DZK, 9FA, 9AK, 9AR, 9AU, 9BF, 9BP, (9CP), (9FS), 9FU, (9GN), (9GX), 9HM, (9IB), 9IZ, 9JN, 9JV, 9LF, 9MC, 9ME, (9MS), 9MQ, 9NQ, 9OA, 9OR, (9OX), (9OU), (9PD), 9PI, 9PJ, (9RC), (9TO), 9TI, 9TL, (9UH), (9UU), (9VL), 9VV, 9WI, 9XI, 9YQ, 9ZN, (Can. 3GN).

**8BIL, Warren, Pa.**

C.W.: 1ARY, 1BDI, 1BEA, 1CAC, 1CGS, 1HE, 1XM, 1ZE, 2BEB, 2BFZ, 2BNZ, 2BR, 2CBG, 2CDA, 2CF, 2FD, 2FP, 2WP, 3ADT, 3AEV, 3AFB, 3AJD, 3ALN, 3AQR, 3ASV, 3BDF, 3BHL, 3BIJ, 3BLF, 3BZ, 3GH, 3HG, 3HJ, 3HX, 3IZ, 3LH, 3LR, 3MO, 3RF, 3TJ, 3ZY, 3ZZ, 4BY, 4EL, 4GL, 4ID, 4LE, 5UU, 5ABO, 5AGO, 5AGZ, 5AFZ, 5ALB, 5ALV, 5AMD, 5AMS, 5AOG, 5AQ, 5AQF, 5AQR, 5ARW, 5AOU, 5AWP, 5BBU, 5BEX, 5BFX, 5BLT, 5BNJ, 5BNU, 5BOX, 5BRL, 5BUM, 5CFP, 5DR, 5GV, 5HJ, 5IQ, 5IV, 5JL, 5JS, 5JU, 5NI, 5OW, 5PU, 5SP, 5UK, 5VY, 5XK, 5XV, 5AAS, 5AAU, 5AAY, 5AJA, 5AJH, 5AJP, 5AKD, 5AKR, 5ALS, 5AOH, 5BBF, 5BIP, 5FM, 5HW, 5IL, 5PG, 5SJ, 5ZB, 5ZL.

Spark: 2BJO, 2EL, 2FP, 2OM, 2XQ, 3AHK, 3FP, 3XM, 3ZO, 4YA, 5JD, 5AFD, 5AHH, 5AVT, 5AXY, 5AYN, 5BRG, 5JJ, 5SP, 5WE, 5XE, 5YM, 5AMS, 5AOE, 5AWX, 5DTN, 5DYU, 5MC, 5OX, 5WT, 5YA.

**8ASL, Fredonia, N. Y.**

Spark: 1AFD, 1AGC, 1ARY, 1AW, 1AZK, 1BCF, 1BQ, 1BQ, 1CH, 1CHL, 1GM, 1OE, 1RU, 2AJE, 2AR, 2ARB, 2BJO, 2FP, 2JU, 2LP, 2OM, 2OO, 2RR, 2XM, 3ACE, 3AER, 3AHU, 3AJD, 3AQH, 3AQR, 3ARM, 3ARN, 3AUW, 3BFU, 3BG, 3CC, 3LU, 3OM, 3QN, 3SQ, 3TS, 3XAE, 3XF, 3YM, 4BX, 4CX, 4DH, 4EA, 4FB, 4GN, 5DA, 5FJ, 5HK, 5PY, 5XA, 5XB, 5XU, 5ZL, 5AAC, 5AAR, 5AAV, 5ADB, 5AEC, 5AFA, 5AFB, 5AFD, 5AFG, 5AGK, 5AHH, (5AHQ), (5AHS), 5AIO, 5AKQ, (5AKW), 5ALL, 5AMB, 5AMH, 5AMZ, 5AOT, 5APB, 5AQH, (5AQL), 5AQW, 5ARD, 5ATU, 5AUE, 5AUG, 5AUO, 5AUU, 5AVO, 5AXC, (5AXQ), (5AYM), 5AYN, 5BAC, 5BAE, 5BAZ, 5BEN, 5BEP, 5BFH, 5BFP, 5BFV, 5BID, 5BZ, 5BQ, 5BQC, 5BTG, 5BXC, 5XX, (5BYP), 5CAY, 5CFE, (5CG), 5CP, 5CQ, 5EW, 5HJ, 5IN, 5JJ, 5JU, (5KU), 5LB, 5MB, 5ME, 5NO, 5OI, 5PY, 5QC, 5QQ, 5SP, 5TK, 5TU, (5TY), 5TZ, 5XC, 5UD, 5UE, 5UF, 5UR, (5VH), 5WO, 5WZ, 5UC, 5XE, 5YAA, 5YAE, 5YN, 5YQ, 5YU, 5ZA, 5ZAC, 5ZAD, 5ZAE, 5ZC, 5ZF, 5ZP, 5ZZ, 9AAW, 9ABL, 9AC, 9ACM, 9ACN, 9AEN, 9AF, 9AFF, 9AGR, 9AHP, 9AIG, 9AIR, 9AJN, 9AKR, 9AMA, 9AMQ, 9AMS, 9AOE, 9AP, 9AQM, 9ASJ, 9AWU, 9AYW, 9AZA, 9AZE, 9BZZ, 9BDS, 9BFX, 9DHV, 9DLX, 9DMW, 9DQO, 9DXM, 9DZE, 9DZQ, 9FH, 9FS, 9GX, 9II, 9IO, 9JN, 9LF, 9OL, 9OX, 9MC, 9NH, 9PW, 9RC, 9TL, 9UH, 9UL, 9VL, 9XI, 9YAE, 9YAC, 9YAI, 9YAK, 9YC, 9YM, 9YQ, 9ZB, 9ZJ.

C.W.: 1ARY, 1AWB, 1BOX, 1CAK, 1CJH, 1XZ, 2AAB, 2AJE, 2AWL, 2BFZ, 2XQ, 3AFU, 3AJD, 3AG, 3AQH, 3AQR, 3AWH, 3BC, 3BG, 3BLF, 3CC, 3CG, 3LF, 3OT, 3PB, 3EF, 3ZZ, 4BY, 4EL, 4GL, 4ID, 5FV, 5KU, 5ADR, 5AIM, 5AIL, (5AIS), 5ABO, 5AMK, 5AOB, 5AOC, 5AOT, 5APT, 5APW, 5AQF, 5ARG, 5AUO, 5AWZ, (5AYT), 5BBK, 5BEF, 5BLR, 5BMA, 5BQL, 5BSF, 5BUM, 5BUX, 5BVR, 5CCM, (5CG), 5CL, 5CIR, 5DE, 5DR, 5HJ, 5IQ, 5JL, 5NB, 5NI, 5PU, 5QB, 5SF, 5UD, 5UF, 5UJ, 5UK, 5WA, 5WY, 5XE, 5ZAE, 5ZZ, 9AJH, 9BED, 9DV, 9HW, 9NX, 9WC, 9YQ.

**8AIM, Dayton, Ohio**

Spark: 1AW, 1RV, 1ARY, 1BCA, 1BGF, 2BK, 2BM, 2FP, 2XQ, 2AID, 2AJE, 3AS, 3CG, 3FB, 3HJ, 3AQR, 3ARM, 4AS, 4EA, 4ER, 4GN, 4GA, 4GU, 5DA, 5ED, 5FJ, 5FV, 5HK, 5XA, 5XU, 5XL, 5ZL, 5ZV, 5ZZ, 5ZAB, 5BA, 5EO, 5FI, 5HU, 5KK, 5KP, 5NO, 5OI, 5QQ, 5SA, 5SG, 5SP, 5VL, 5WD, 5XE, 5YN, 5YO, 5ACV, 5ADS, 5AFB, 5AFD, 5AHU, 5AKW, 5AIG, 5AIT, 5AIZ, 5ARS, 5AXS, 5AXN, 5AYP, 5AZV, 5BBI, 5BCO, 5BEF, 5BRL, 5BVN, 5CCQ, 5YAC, 9AF, 9CA, 9GX, 9HR, 9LF.



9MC, 9PD, 9TL, 9UG, 9UU, 9WA, 9YA, 9YB, 9YC, 9YM, 9YO, 9YQ, 9ZJ, 9ZN, 9AAW, 9AEG, 9AEK, 9AHJ, 9AIF, 9ALH, 9AOJ, 9APS, 9AQE, 9ARG, 9ARI, 9AYY, 9AZA, 9BRL, 9DHG, 9DQJ, 9DWP.  
C.W.: 1QN, 1RU, 1UN, 1XM, 1ZE, 1AFV, 1AJP, 1ANQ, 1ARY, 1AVI, 1BCG, 1BDI, 1BKA, 1BSD, 1BUA, 1BB, 2DH, 2EH, 2FD, 2HG, 2KL, 2NZ, 2QK, 2RM, 2VA, 2WP, 2XQ, 2ZL, 2ZV, 2AAB, 2AAV, 2AAX, 2AGB, 2AJF, 2AKO, 2AIR, 2ANQ, 2AWF, 2AWL, 2AYZ, 2BAK, 2BEA, 2BFZ, 2BGH, 2BGT, 2BIS, 2BSC, 2BYS, 2CYS, 3BG, 3BP, 3BY, 3BZ, 3CA, 3CC, 3DH, 3HG, 3HJ, 3IW, 3LR, 3MO, 3RF, 3TJ, 3XL, 3ZO, 3ZV, 3ZY, 3ZZ, 3AAO, 3AEV, 3AJD, 3AMA, 3APA, 3AQR, 3BEC, 3BHL, 3BIK, 3BIY, 3BLF, 3ZAB, 4AS, 4BK, 4BY, 4BQ, 4CG, 4CY, 4DC, 4EB, 4EL, 4EN, 4FT, 4GL, 4ID, 4IL, 4XD, 4YA, 4ZE, 5FA, 5FV, 5LA, 5UU, 5XJ, 5ZA, 5AR, 5BK, 5BU, 5DV, 5DR, 5GA, 5GV, 5IB, 5IQ, 5JD, 5JL, 5KH, 5ML, 5NB, 5NV, 5QY, 5RG, 5SP, 5UO, 5VJ, 5WA, 5WR, 5WY, 5XB, 5XK, 5XM, 5XV, 5XY, 5ZG, 5ZL, 5ZP, 5ZV, 5ZZ, 5ADG, 5AGG, 5AGL, 5AGO, 5AHR, 5AJG, 5ALB, 5ALV, 5AMM, 5AMQ, 5AMS, 5ANP, 5AOG, 5AOZ, 5APT, 5AQF, 5AQH, 5AQN, 5AQR, 5AQV, 5AQZ, 5AWP, 5AWY, 5AXC, 5BCI, 5BIJ, 5BJV, 5BJW, 5BLT, 5BNI, 5BND, 5BRC, 5BRF, 5BRL, 5BZO, 5CAB, 5CAZ, 5CR, 5DV, 5IO, 5LK, 5NX, 5OU, 5PF, 5QE, 5VG, 5WC, 5XM, 5YB, 5ZY, 5AAS, 5AJA, 5AJH, 5AJP, 5AMB, 5AMU, 5AKD, 5BAP, 5BBF, 5BED, 5BLO, 5BOW, 5DFL, 5DKP, 5DWJ, 5XAB.

#### 8GY, Cleveland, Ohio

C.W.: 1AAN, 1AAX, 1ANQ, 1ANY, 1AFV, 1ARY, 1AZW, 1AWK, 1AWN, 1BBT, 1BDI, 1BKO, 1BKQ, 1BYK, 1CAK, 1DF, 1FF, 1QN, 1TS, 1XF, 1XAD, 1ZE, 2AWL, 2AUU, 2AUC, 2AAB, 2ABK, 2AM, 2AJR, 2AFP, 2BTJ, 2BYS, 2BFZ, 2BGH, 2BEB, 2BB, 2BAK, 2CBG, 2CCD, 2FD, 2FP, 2FZ, 2OM, 2OT, 2RB, 2RM, 2WB, 2WP, 2VA, 2XA, 2XJ, 2XQ, 2ZL, 2ZY, 3AAE, 3ADT, 3ADX, 3AHK, 3AJH, 3ALN, 3ANK, 3AQR, 3ARK, 3AWY, 3BA, 3BAY, 3BC, 3BEC, 3BIY, 3BLF, 3BP, 3BF, 3CA, 3DH, 3DP, 3FM, 3FM (Canadian), 3FS, 3HG, 3HS, 3JH, 3KM, 3LR, 3MO, 3MY, 3OM, 3TJ, 3XM, 3ZN, 3ZO, 3ZY, 4BK, 4BY, 4CO, 4CY, 4EB, 4EL, 4EN, 4FT, 4GL, 4HW, 4KL, 4LE, 4YA, 4ZE, 5AF, 5AN, 5FV, 5KP, 5MB, 5NZ, 5QA, 5UU, 5YH, 5YL, 5ZA, 5ZE, 5ZZ, 6EN, 6XAD, 6ZA, 9AAV, 9AAV, 9AAU, 9AEG, 9AFF, 9AIG, 9AJA, 9AJP, 9AJH, 9AKH, 9AKB, 9AKR, 9ALS, 9AMU, 9AOG, 9AOE, 9ARK, 9ARG, 9ARS, 9AUA, 9YS, 9BAP, 9BBF, 9BED, 9BIK, 9DCE, 9DGM, 9DPQ, 9DWJ, 9DY, 9EI, 9FM, 9HW, 9IL, 9IO, 9JD, 9JL, 9LQ, 9MT, 9NX, 9OR, 9PG, 9PS, 9RE, 9WU, 9XAQ, 9XI, 9XM, 9ZB, 9ZL, 9ZT, 9ZY.

Spark: 1AER, 1ARY, 1BKQ, 2AAB, 2ACH, 2ARK, 2CK, 2EL, 2EQ, 2FP, 2OM, 2XK, 2XQ, 3ACM, 3AC, 3AR, 3ANK, 3BP (Can.), 3BG, 3EH, 3EI, 3FG, 3KM, 3NB, 3PU, 3SG, 3VA, 3VR, 3VW, 3XF, 3XM, 3ZO, 3ZV, 3ZY, 4BI, 4BQ, 4CA, 4CX, 4DH, 4EL, 4HT, 4XF, 5AK, 5DA, 5EK, 5FJ, 5JD, 5LO, 5PX, 5UU, 5XA, 5XB, 5XU, 5YL, 5ZA, 5ZE, 5ZL, 5ZZ, 7XB, 9ACB, 9AEY, 9AFF, 9AIU, 9AIY, 9AIG, 9ANI, 9AOE, 9AQE, 9ARD, 9AV, 9AVP, 9AWX, 9AWR, 9AWZ, 9BNT, 9BYA, 9CA, 9DKV, 9DZI, 9DQ, 9DQJ, 9DQC, 9DLX, 9DWP, 9DYU, 9DV, 9EJ, 9EE, 9GS, 9HR, 9HI, 9HM, 9IW, 9JN, 9JQ, 9LW, 9MC, 9MX, 9NQ, 9NX, 9OX, 9OA, 9PS, 9RC, 9UH, 9UK, 9UU, 9VL, 9WN, 9WT, 9WD, 9XA, 9XAC, 9XAE, 9XAF, 9XI, 9YB, 9YA, 9YAC, 9YAE, 9YAF, 9YAJ, 9YAK, 9YC, 9ZC, 9ZJ, 9ZN, 9ZZ.

#### 8CAB, Cincinnati, Ohio

C.W.: 1AZW, 1BEA, 1BDI, 2AAB, 2AZZ, 2BAY, 2BEB, (2BFZ), 2CCD, 2WP, 2XA, 3AHK, 3AJD, 3AQR, 3BIY, 3BLF, 3BZ, 3FS, 3HG, 3HJ, 3HX, 3LR, 3ZY, 4AS, 4BK, 4BQ, (4BY), 4CY, 4EL, 4FT, 4GL, 4ID, 4II, 4XK, 4ZE, 5EK, (5FV), 5KP, 5LA, 5MT, (5UU), 5ZL, (8ABV), 8AGL, 8AGZ, 8AIM, 8AJO, 8AMS, 8AQF, 8AQH, 8AQV, 8ATU, (8AWZ), 8AXC, 8BDO, (8BET), (8BEX), (8BFX), 8BK, 8BMB, 8BOG, 8BOX, 8CBR, 8DR, 8IQ, 8IV, 8JS, 8QM, 8SP, (8VY), 8XE, 8XV, 8ZZ, 9AAU, 9AJH, 9AKB, 9AKR, 9AOQ, 9APE, 9AT, (9AUA), 9AVN, 9AYS, 9BBF, 9BIK, 9DCB, 9DIG, 9DKP, 9DPQ, 9DTW, (9EI), 9EL, 9FM, 9HK, 9IZ, 9JL, 9NX, 9QR, 9SR, 9UU, 9WC, 9XI, 9ZL, 9ZY.

#### 9YAJ, Northfield, Minn.

Spark: 2FP, 3XM, 5AQ, 5BM, 5BY, 5EK, 5EW, 5FO, 5HK, 5IF, 5IR, 5IS, 5MF, 5NK, 5PG, 5SM, 5XB, 5XU, 5YI, 5ZA, 5ZL, 5ZZ, 7MP, 7ZO, 7ZU, 7ZV, 8AIT, 8AZN, 8AGZ, 8AMZ, 8AWP, 8AYN, 8BA, 8BF, 8BFH, 8CF, 8CP, 8EA, 8EB, 8JJ, 8KK, 8MJ, 8UR, 8VY, 8WO, 8YN, 8ZA, 8ZAA, (8ZP), 9AAP, 9AAS, 9ABV, 9ACB, 9ACL, 9ACN, 9ACY, 9ADM, 9AEG, 9AF, 9AFF, 9AFX, (9AFW), 9AIR, 9AGN, 9AGR, 9AHZ, 9AIF, 9AIS, (9AIG), 9AKO, 9ALS, 9ALM, 9ALO, (9ALU), 9AMB, 9AMQ, 9AMS, 9ANF, 9ANO, 9ANQ, 9AOE, 9AOJ, 9AOU, 9APW, 9AQE, 9AQM, 9ARG, 9ARZ, (9ASK), 9ASO, (9ASN), 9ATN, (9ATV), 9AU, (9AUA), (9AUL), 9AUU, 9AVC, 9AVE, (9AVX), 9AWM, 9AXQ, 9AXU, 9AYW, 9AZA, 9AZE, 9BCF, (9BCP), (9BFT), 9BJV, (9BKP), 9BP, 9CP, 9CS, 9DAG, 9DAO, 9DGT, (9DEH), 9DJJ, 9DJX, 9DKQ, 9DKV, (9DOK), (9DOO), (9DOT), 9DP, 9DTB, 9DFM, 9DQJ, 9DQU, 9DSJ, 9DSN, 9DSO, 9DUD, 9DUU, (9UG), 9DV, 9DWP, 9DXM, 9DYG, 9DYU, 9DZJ, 9DZQ, 9ET, 9GC, 9HI, (9HM), 9HT, 9JN, 9JO, 9LF, 9LN, 9LR, 9MS, 9NQ, 9PB, 9PD, 9PI, 9PS, (9QE), 9RC, 9RY, 9TL, 9UH, (9VL), (9WF), 9WI, 9WT, 9WX, 9XAI, 9XJ, (9XI), 9XT, 9YA, (9YAE), 9YAK, 9YB, 9YC, 9YM, 9YQ, 9ZAC, 9ZAH, (9ZC), (9ZJ), 9ZN, (9ZT).  
C.W.: 1AFV, 1ARY, 1DF, 1XM, 3BP, 4CB Can., 4BQ, 5BJ, 5FT, 5KU, 5XU, 5ZA, 5ZAB, 5ZAC, 8ALD, 8AMQ, 8AOG, 8AIG, 8APT, 8AR, 8ARS, 8ASV, 8BFX, 8BK, 8BOX, 8BRL, 8BUM, 8DR, 8IQ, 8IV, 8JZ, 8OW, 8QY, 8SP, 8SC, 8UJ, 8UK, 8VY, 8YU, 8ZC, 8ZG, 8AEQ, 9AJA, 9AJP, 9AKB, 9AKD, 9APW, 9ADG, 9ARK, 9AVM, 9AVN, 9AYS, 9BAA, (9BBF), 9BED, 9BIK, 9BJV, 9BLO, 9BNO, 9BOW, 9DNT, 9DOF, 9DTA, (9DQM), 9DVJ, 9DUP, 9DWJ, 9DZQ, 9EX, 9FM, 9FO, 9HW, 9JL, 9JW, (9NX), 9PG, (9QE), 9VE, 9WU, 9XAI (9XI), 9XM, (9ZT).

#### 9DUN, Caney, Kans., January

Spark: 5AQ, 5EW, 5FO, 5HK, 5JR, 5LB, 5LO, 5QL, 5XA, 5XB, 5XJ, 5XU, 5YL, 5ZA, 5ZAB, 5ZAK, 5ZAT, 5ZE, 5ZN, 5ZS, 5ZZ, 7ZU, 7ZO, 8YU, 8ZN, 9AEG, 9AEY, 9AIG, 9AJS, 9ANQ, 9AOE, 9AQE, 9ATU, 9AVC, 9AVR, 9BNJ, 9BMW, 9DHB, 9DKQ, 9DMW, 9DUB, 9DUU, 9EE, 9EJ, 9HR, 9JN, 9JQ, 9LW, 9MC, 9NR, 9PI, 9PS, 9TJS, 9WU, 9XAE, 9XB, 9YAE, 9YAK, 9YM, 9YO, 9ZC, 9ZH, 9ZN, 9ZR.  
C.W.: 4BK, 4BY, 4EL, 4FT, 4ID, 5AN, 5AM, 5BQ, 5FV, 5KP, 5UU, 5XJ, 5YL, 5ZA, 5ZAK, 5ZZ, 6WV, 8AQF, 9AQH, 8BEX, 8BIX, 8BOX, 8IV, 8XV, 8ZZ, 9AAS, 9ACB, 9AII, 9AJA, 9AKB, 9AKR, 9AKS, 9AMB, 9AQA, 9AQB, 9ARJ, 9AUA, 9AVN, 9AYI, 9AYS, 9BAP, 9BED, 9BFX, 9BIK, 9BJI, 9BKK, 9DCE, 9DHB, 9DIG, 9DKP, 9DPE, 9DTW, 9EA, 9FM, 9HK, 9II, 9JR, 9NX, 9PL, 9QE, 9VK, 9XAE, 9XAQ, 9XI, 9XM.

#### 9ASN, St. Paul, Minn.

Spark: (2FP), 3AHK, 4BI, 4EL, 4DH, 4XC, 5HZ, (5JD), 5LO, 5MF, 5PG, 5PP, 5QS, 5SM, 5XB, 5XJ, 5XU, 5YE, 5YI, 5ZL, 7MP, 7YA, 7ZU, 7ZJ, (8EA), 8JJ, 8MR, 8TJ, 8TK, 8UC, 8VC, 8WD, 8YM, 8YN, 8YU, 8AMZ, 8AVO, 8ZP, (8BBU), 8BFH, 8BXX, 8ZAC, Can. 3BP, 3KG, 3GN, (9AR), (9AU), (9AV), 9BP, 9CA, (9CF), 9CS, 9EE, 9EL, 9GP, (9HI), 9IF, (9IY), 9JN, (9JQ), 9LZ, (9MS), (9NQ), (9OA), 9OX, (9PD), 9PS, 9QH, (9RC), 9RY, 9TL, 9UH, 9UU, (9VL), 9WT, 9XM, 9YC, 9YM, 9ZB, 9ZC, 9ZJ, 9ZN, (9ZX), 9ACN, 9ACY, 9AEG, 9AEK, (9AFF), (9AFW), 9AGN, (9AGR), 9AHZ, (9AIF), (9AIG), 9AIP, 9AIS, 9AIU, 9AJA, 9ALS, (9ALU), 9AMQ, 9ANO, 9ANQ, 9AOE, 9AOJ, 9APN, 9ARG, (9ARI), (9ASO), 9ATC, 9ATN, 9AVE, 9AWX, (9AWZ), 9AYH, 9AYW, 9AZE, (9BCF), 9BDS, 9BMN, 9DDE, (9DEH), 9DIW, (9DKQ), (9DKV), (9DKW), (9DLX), 9DNC, 9DPE, 9DPF, (9DRJ), 9DSJ, (9DSO), (9DUG), 9DYU, 9XAI, 9XAQ, 9YAE, (9YAJ), 9YAK.  
C.W.: 1XM, 2FP, 2WP, 3CY, 3EM, 3ZY, 3AQR, 4FT, 5KU, 5ZA, 6ALE, 6XAD, 8AR, 8IQ, 8JL, 8LX, 8UK, 8UO, 8VJ, 8VY, 8WA, 8XX, 8ZG, 8AGZ, 8AJO, 8APT, 8AWP, 8BEF, 8BFX, 8BRL, 8BUM, 9FM, (9HW), 9JL, 9NX, 9PG, 9QE, 9XM, 9YE, 9ZL, 9AJA, 9AKB, 9ALG, 9ALS, 9AOG, 9AQS, 9AYS, 9BBF, 9BIK, 9DVA, 9DZQ, 9XAQ.

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# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Amateur Phone QRM

Editor, QST—

Up to this time I have been merely one of the vast army of readers who are willing to read and enjoy your most excellent publication without passing my own opinion as to the merits of the many articles by the editor or the radio man who from time to time bring up ideas for the betterment of Citizen Radio.

However I am now getting into the ring in regard to what I believe will sooner or later prove a real menace to relay work, which is by far the more important thing in Citizen Radio. I wonder if the radiophone stations who are springing up in all parts of the country realize that many of them during their interminable periods of testing and transmitting so-called concerts are, as a rule, causing as much interference as the worst squeak box?

There is plenty of good music in the air these nights from such stations as WJZ, WDY, KDKA, 1XE, etc. on regular schedule and who are putting on excellent talent with fine modulation. These stations do not interfere with traffic in any way as they are on 360 meters or higher. Befng commercial or special amateur stations they are permitted these wave lengths which the average phone station should realize is illegal for them.

I am sure I find it hard to understand why so many of the new phone stations think it is necessary to clutter up an already over-crowded atmosphere with a jumbled-up mess of A.C. hum; some use no filter system whatever. And the modulation as a rule is so bad that when they talk it sounds as though they had a mouth full of hot potatoes. The majority seem to think that high radiation is much more important than good clear modulation.

I have night after night heard a local station transmit alleged music from eight to ten thirty P.M. when their A.C. hum was so bad owing to a poor filter and poor rectification that it was utterly impossible to tune him out on a range of from 185 meters to 550 meters. Therefore it was impossible to copy distant amateur spark stations and also impossible to listen to good music from the few good radiophone broadcasting stations. The modulation, of course, was so poor that it was hard to understand the speech.

The operator at that station on many nights is an unlicensed man who can not understand a letter of code and would not therefore recognize a QRX or QRT signal even if transmitted at one word a minute.

I will say that I believe that the A.R.R.L. should take this matter of radiophone QRM under consideration as no doubt this locality is not the only one suffering from this form of interference. In case you care to use any part of this in QST I request that my name be withheld from print as I do not wish to cause hard feelings but have the betterment of conditions at heart.

Very sincerely yours,  
A Reader.

## Intermediate Signals

NAA Control,  
Room 2629, Navy Dept.,  
Washington, D. C.

Editor, QST—

In regard to Mr. Rosebank's letter in the January QST, I may be able to let a little light in on the subject. The intermediate signal . . . — is used in the place of — . . . in the new naval procedure, and is authorized and correct for any U.S. Naval station to use when using tactical signals. The attention call in this case is . . . — instead of — . . . — also. These signals are unauthorized however for commercial work, even by naval stations. For Mr. Rosebank's information, the stations whose first letter of the call is N are U.S. Naval stations. WII and WSO are not authorized to use these signals, nor is NSM for commercial work, which is almost entirely what he and NNZ handle. If Mr. Rosebank will listen to the arcs of NAA, NAO, NAR, NAW, and NAT, also NSS and NDD when working U.S. Naval stations, he will hear these signals used entirely, and also a number of other unfamiliar signals comprising the new Naval tactical procedure. This does not violate the radiotelegraphic convention, and the A.R.R.L. distinguishing signals hold good for amateur stations only. Best 73s.

H. J. Burhop,  
9ZL (when at home).

## Canadian Tubes

Wolfville, Nova Scotia.

Dear Eddie—

Thought you might like to hear some-

thing about the valves available for amateur use in Canada.

The U.S. tubes are in use at a great many stations. The most widely used type however is the British Marconi "V-24." This is a hard tube, and though primarily designed as an amplifier, is an A1 all around valve. Those who have tried it in radio frequency amplifiers have obtained excellent results as it possesses a rather low internal capacity, and on account of its amplifying properties it can not be excelled when used as a detector in a regenerative circuit. The normal filament current and voltage are .75 and 6 respectively, while a potential of 22½ volts is applied to the plate.

The Marconi "Q" type, while being as good a detector as one could wish for, is rather difficult to adjust to maximum efficiency and requires quite a high voltage on the anode so is not in general use among the amateurs. The "V-24" has very small elements. The "Q" has a large plate and small mesh grid so that a very small change of potential in the latter will cause a violent change in the plate current.

As transmitters either of the above mentioned tubes give excellent results for low power work. Then we have the Marconi "MT-5" a 25 watt tube, "MT-1", 250 watts; "MT-3", 75 watts; "MT-4", 400 watts, and "MT-2" a 1000 watt tube, and the English Mullard type "A" valve, a 30 watt tube, the filament of which draws but .8 amps. Voltages of 400 to 1000 may be used on the plate of this latter tube. Marconi rectifiers "MR-1" and "MR-4" of 150 and 400 watts respectively are also obtainable.

A large Toronto department store is stocking a full line of tubes, including some of French and Japanese make. And last but not least it is rumored that one of the largest electrical companies in the Dominion has a full line of tubes about ready for the amateur market.

Very truly yours,  
C. H. Starr.

### High Frequency Resistance

Standard Radio & Electric Co.,  
Pawtucket, R. I.

Editor, QST—

I have just read with deep interest in the November issue of a leading radio paper an article, apparently recommended to the amateur, on "Construction of a Long Wave Receiving Set."

It is the evident intention of the writer to convey in this article a method of constructing a long wave receiver of distinctive merit; and his appeal is to the amateur.

In describing the coil windings, he proposes ordinary spool-windings in multi-layers, the total primary to be wound in two sections and the secondary in three, the total making sort of a loose-coupler.

Further, advocating his method, he does not hesitate to lay claim to superiority over conventional concentrated coils while speaking of the remarkable results obtained by the method employed.

With a lively interest in the amateur, that he shall not devote his efforts along lines which I feel sure will not result in the satisfaction sought, I take exception to certain statements and will endeavor to impart views which are based on many years experience, acquired by experimentation, research, and reading in this particular field; and most especially where coils for use in radio frequency are discussed.

In the first place, it is common knowledge that coils wound in multi-layers or "spool-winding" contain a tremendous amount of distributed capacity; it is also well understood that this is to be particularly avoided, and especially in the case of the amateur, who is generally working with antennae of low capacity and who therefore requires that the capacity of his set be a minimum.

In the next case, in general or "spool-winding" it is customary for the turns to be wound close together. Here the crowding of the skin effects result in a very large high-frequency resistance which obviously result in a decided decrease in signal strength.

Again: strange, as it may seem it is nevertheless true that the D.C. resistance of a coil has absolutely no bearing or relation to the high-frequency resistance. This is not generally understood today, and has fooled many advanced students of the art in the past. To substantiate these statements I will cite a case where two coils were recently tested at Cruft Laboratory, Harvard University, and the above found unquestionably true.

#### Coil A

Coil constructed of No. 25 S.C. wire, D.C. resistance 11.26 ohms

|                            |        |      |
|----------------------------|--------|------|
| At 6000 meters, H.F. Res.= | 115.0  | ohms |
| " 8000 " " " "             | = 54.0 | "    |
| " 10000 " " " "            | = 39.6 | "    |
| " 15000 " " " "            | = 23.2 | "    |

#### Coil B

Coil constructed of No. 24 S.C. wire, D.C. resistance 9.9 ohms

|                            |        |      |
|----------------------------|--------|------|
| At 6000 meters, H.F. Res.= | 115.0  | ohms |
| " 8000 " " " "             | = 77.0 | "    |
| " 10000 " " " "            | = 52.4 | "    |
| " 15000 " " " "            | = 28.7 | "    |

Even a casual glance at the above data brings out the peculiar fact that the coil with the larger wire, and consequently of course less D.C. resistance, actually shows more H.F. resistance. Yet it is possible, and furthermore it is at present accomplished and a commercial fact, that these coils can be, and are, so wound that the larger wire will have the smaller H.F. resistance. From this it becomes evident that the method of winding must have con-

siderable to do with this matter. It is, in fact, the answer to that problem, and by a special method of winding we do bring down H.F. resistance.

Lastly, I must definitely state that, in my opinion, based on tests of course, there is nothing to be gained by spreading both the primary and secondary winding out on a long tube with the idea of producing a sort of "loose-coupler effect." At first blush it might seem to one that this method would tend to reduce distributed capacity. This is true to a certain extent, but why spread out the whole tuner into a big cumbersome unit, when the same inductance can be obtained in a small properly-constructed coil, still having less distributed capacity? Below will be found examples of actual values received by authoritative tests, and which will bear out the above statements.

Coil A, an inductance constituting 1000 turns made up of four sections of 250 turns each and wound honeycomb, these placed side by side on a long tube of 4" or 4½" diameter. Total inductance, 65.4 millihenries. Distributed capacity, 12.8 mmfds.

A properly wound concentrated inductance revealed inductance of 165 millihenries; distributed capacity, 8.4 mmfds.

Another case of lower inductance shows inductance of 31.3 millihenries, distributed capacity of 8.5 mmfds.

In the article under discussion this statement appears: "In the first tests made, while perfecting an instrument especially designed for receiving long wave lengths, 'concentrated coils' of the conventional cross-wound type were used, but, surprising as it may seem, signals were increased 50 to 75% when the layer-wound coils were substituted, one reason being that the D.C. resistance is much lower."

I take exception to the first part of the above paragraph, as this condition is absolutely contrary to any I have found in tests, and I would appreciate any actual test figures covering such an instance. However, I have already demonstrated, in figures shown above, that there exists absolutely no direct relation between D.C. and H.F. resistance.

The statement goes on to say, "losses due to varnish are less because varnish is only applied to the outer layer." I can only say that in tests actually conducted, to find possible losses due to varnish, results have demonstrated negligible losses and so small as not to be apparent on the meter.

It is to be noted that the Navy Department specify varnished coils. From this point it might be gathered that while they accept the varnish (as valuable) where salt air is encountered, they certainly would not consider it for a moment if it occasioned

losses. A summary of all my data to date proves conclusively to me that the method of winding the coil, and of course attention to the kind of wire used, absolutely controls distributed capacity and high frequency resistance.

I especially hope that this criticism will be accepted in the spirit that it is given, namely, a friendly discussion of points that are entirely at variance with the results of my own observation and what might be termed exhaustive tests on the subject. However, I do certainly insist that these values in different types of coil winding be cleared up; so that a theory on the one hand, is hereby exploded, and the above statements accepted; or further discussion be given this subject.

I gratefully acknowledge indebtedness and thank Cruft Laboratory professors for their co-operation in obtaining data herein referred to.

Thos. P. Giblin,  
Electrical Engineer.

### A New Idea

Box 1026,  
Gulfport, Miss.

Editor, QST—

While not having accomplished anything that entitles me to be listed among the amateurs I am nevertheless keenly interested in all radio matters; and it was while thinking along these lines that I stumbled upon a curious and interesting phenomenon which, if it has ever before been noted and written about, has certainly escaped my attention.

I possess a small violet ray outfit—the kind in which everything is self-contained in the handle. It is, as is well known, a therapeutic device that finds favor with many for ameliorating a wide range of human ailments—from renal deficiency to falling hair. This little panacea is built to operate on 110 volts, D. or A.C., has a fathom or so of cord to connect with the usual electric light socket, and is priced at around fifteen dollars. Now it had often occurred to me that it's spark, being obviously one of high frequency, ought to be detectable in radio receivers; so to ascertain the possibility of this I recently screwed the cord into a deck socket aft, and broke the sparking from the applicator into comprehensible dots and dashes by alternately advancing and retracting the glass while held alongside an iron stanchion. Thereupon my radio man, Mr. Wm. M. Smith, (an excellent operator and technician, by the way) reported with great enthusiasm that he had received all that I had attempted to transmit, and that it had come in "like a ton of bricks".

Encouraged by the successful outcome of the above experiment I shifted the little violet ray device to my hotel, almost a mile away but with no metal obstructions inter-

vening. In the second test I used a large screen door as an antenna operating as with the stanchion; my messages still were received strong and distinct. We propose to continue our experiments, to ascertain if varying angles of the door to the ship have appreciable effect, and to learn the absolute limiting distance at which this simple violet ray apparatus may be heard. The ship's receiving set is the Navy Standard (NSE-1420-C) and is manufactured, I believe, by the American Radio & Research Corporation.

Respectfully,  
Eoline R. Hand, H&GE,  
Comdg. Str. "Bache".

### Rotten Modulation

Cambridge, Mass.

Dear Editor—

Pursuing the subject of radiofones a bit further, is it not in order that we become more particular about our plate-power filters?

As stated in a previous letter we are entirely too careless in the matter of quality—anything that puts thru fairly intelligible speech seems to be satisfactory.

The operator of a fone need never be in the dark as to either point—a coil of wire, a variable condenser, a crystal detector and the headset make an excellent tester. If the pick-up circuit can be coupled to the sending helix so closely that the detector is on the verge of a burn-out without destroying the quality, the phone is at least not very bad. If it does not pass this test with flying colors the fone is rotten beyond expression. A good sturdy crystal detector such as carborundum or silicon-arsenic should be used.

No reliance at all can be placed on listeners' reports, for the average man seems to lack moral courage to say truthfully "Your quality is terrible" or for heaven's sake put a filter on your plate supply. That thing you use is a farce."

Last night I heard three stations tell the operator of a 150-watt fone set "That's F.B., O.M." tho his speech rattled badly and his music sounded as if it had been run thru a meat chopper by reason of a commutator roar almost as loud as the music.

Let's help the fone by being honest.

Sincerely,  
S. Kruse.

### Gen. Russel Congratulates A.R.R.L.

The University Club,  
Fifth Avenue & 54th Street,  
New York City.  
Dec. 16, 1921.

My dear Mr. Maxim:

I have followed with much interest the course of the experiments made by the American Radio Relay League in trans-At-

lantic radio transmission, and have marked with great satisfaction their success.

I congratulate you and the League on this wonderful achievement. It certainly has great significance as the forerunner of regular practice along these lines.

It is a fresh proof of the value of organization in successfully capitalizing the energy, skill and enthusiasm of our radio amateurs.

Very truly yours,  
Edgar Russel,  
Brig. General, U. S. A.

(Formerly Signal Officer 2nd Corps Area, N. Y.)

### More About Licenses

Bala, Penna.

Editor, QST—

I would like to say a few words on the question of grading amateur stations and charging for licenses, and bring out a few points for the consideration of those interested in the discussion that has appeared in QST from time to time.

Congress has appropriated an inadequate sum for the use of the Department of Commerce in carrying on the work of its Radio Department, and without money there will be no increase in inspectors while those now appointed are already more than busy with the more important work of inspecting ships, and have no opportunity of covering the amateur field thoroughly. The present law does not necessarily need changing; it needs obeying, and no amount of advice and urging from individuals, District Councils, A.R.R.L. editorials or local clubs will be more than half effective because there are certain amateurs who are so devoid of responsibility that nothing short of actual authority will bring them up short and start them along the straight and narrow 200 meter path.

Fancy-priced licenses or graded wave lengths only complicate the present law, without arriving at the desired end; if Commerce can't enforce the present law, what will happen by introducing more provisions which call for twice as much office work and inspection?

Commerce spends thousands of dollars annually in examining amateurs, issuing licenses, paying the salaries of clerks and inspectors who do the clerical and examination work, and what do we, the amateurs who get the most benefit, contribute toward the support of Commerce? Not a cent, except a 2c stamp for blanks, and 50c for notary's fee. The American taxpayer, who is not directly interested in amateur wireless and gets no direct benefits therefrom, pays the bill, while we bring home the bacon. The least and fairest thing we could do is to offer Commerce something in return for the work they do and make it possible for them to give us adequate inspection service.

It will not be long before the amateur novice, who listens to the radiophone broadcasts and cares nothing about the radio amateurs with the transmitting set, will outnumber the latter and then look out for legislation that will try and wipe us out, put the lid on for good. Notwithstanding this fact, there are lots of amateurs who totally and knowingly disregard the wave length and decrement regulations and their obligations to other law-abiding amateurs, and unless this kind is confronted by a government official and a shiny silver badge, they will bring the entire amateur fraternity into disrepute.

A license charge of \$2 for a transmitting set and \$1 for receiving is within the reach of everybody and yet a small nominal charge of this kind would make it possible for the Department of Commerce to appoint enough inspectors to enforce the law all over the country. When we get this, it's time enough to begin thinking of asking for wider amateur wave length bands. Without more money, Commerce can't enforce the law; without enforcement some amateurs won't keep within bounds and without keeping in bounds we're going to start trouble for ourselves. A small license fee won't hurt anybody and will do the trick for us all.

Sincerely,  
C. A. Service, Jr.,  
3ZA.

### Who's Using 8ZY?

Office of Radio Inspector,  
Federal Bldg., Detroit, Mich.  
Jan. 11, 1922.

My dear Mr. Warner—

There have been a number of complaints filed against the special amateur station of Mr. K. A. Duerk, (8ZY, Defiance, Ohio.) These complaints state that he has caused interference with the broadcasting of music from the Westinghouse broadcasting stations at Pittsburgh and Newark, N. J. Mr. Duerk is licensed for operation on 375 meters and Westinghouse are operating on 360 meters. I have taken this matter up with Mr. Duerk and he informs me that his station has not been in operation for some time. From this I am lead to believe that someone is using his call letters. It may be that this is being done to discredit Mr. Duerk and cause him embarrassment and trouble. I am inclined to favor Mr. Duerk's case and believe that he did not willfully cause any interference. This letter is to suggest that you insert in the columns of your valuable magazine a notice to the effect that if the party or parties who are using Mr. Duerk's call letters, 8ZY, are located, this office will not hesitate one moment in bringing the case to the attention of the United States District Attorney and request vigorous prosecution. Prosecution

of such a case would be requested under Section Seven of the Act of August 13th, 1912, which we believe fully covers such cases.

No amateur should use the official call of another station. When he does so he violates Section Seven, inasmuch as he transmits a fraudulent call. There is no doubt in my mind but that the Department of Commerce can secure a conviction in such cases.

I will appreciate it very much if you will give this request as much publication as possible.

I am extending to you my best wishes for a prosperous New Year.

Respectfully,  
S. W. Edwards,  
U.S. Radio Inspector.

### C.W. Wave Length

Fort Riley, Kan.

Editor, QST:

Now that DX work on 200 meters is common practice with very little power, the staunchest supporters of the old rock-crusher are remodeling their post cards on the typewriter and if you can read through the XXXX you will learn that at one time, not so long past the writer sent blue whiskered amperes through an N-pointed rotary and that he had a lot of plate glass immersed in oil. The same man is now using the oil in a little variable condenser and his rotary is running a chopper. If you work him, he is as enthusiastic about CW as he ever was about spark and then some.

Strange to say this old verteran will have but a hazy idea of what his wave length is and bases his opinion on reports of his brother amateurs—something he never would have done when he had the old spark set. The answer is obvious; the wave length of a CW set is hard to measure.

Suggestion to Mr. Schnell: That certain stations, CW and Spk., be appointed to do as FL does,—at stated intervals, send out signals on stated wave lengths.

9DTW has a Kolster decremeter and has had many requests for this service which is rendered gladly in the communication range of the station which unfortunately is only equipt with two five-watt tubes. Such information broadcasted by high power stations would give everybody a chance to calibrate his receiver and render valuable service to others in his vicinity. It would give us a fine chance to make a correction curve for that wave-meter which fell off the top shelf last week too. A wave meter has a bad habit of exaggerating after such an experience, and its tendency to fabricate in one direction or the other is well known. Yes, the Bureau of Standards will do it but it costs money and takes quite some time.

F. M. Ende, 9DTW.

## The Reinartz Tuner

Cambridge, Mass.

Dear Editor—

The Reinartz C.W. tuner deserves some enthusiastic booming of which this is a small share.

At 3AB1 we performed the following test. We first put in a 3-coil set and copied C.W. calls for half an hour. It was a good set and we were familiar with it. At the end of half an hour we had 18 C.W. calls thru the local QRM.

Then we put in a Reinartz tuner and copied 42 C.W. calls in the next half hour, every one of them more readable than the best of the previous lot.

The simplicity of the control is remarkable and a swinging wave can be followed with ease. For spark work I cannot recommend it but for C.W. it is the long-desired two-control tuner "on which there will be two knobs, one for tuning and one for regeneration."

I understand Mr. Reinartz has recently "simplified" the tuner. How? How? What can be simpler than a two-control tuner that knows not the meaning of "body capacity effect"?

Sincerely,  
S. Kruse, "LQ".

### CALLS HEARD (Concluded from page 59)

9AMZ, Evanston, Ill.

Spark: 1AZK, 1XM, 2BK, 2BM, 2FP, (2JZ), 2OM, 3AJD, 3ARN, 3CI, 3BY, 3FO, 3HK, 3PG, 3SM, 3ZL, 3AFD, 3AIZ, 3AMZ, 3ARS, 3AYX, 3AXN, 3BA, (3BBU), 3BBO, 3BHV, 3BRL, 3BXC, (3BZZ), 3CAY, 3CGZ, 3CI, 3CP, 3EB, 3FT, 3JJ, 3MR, 3OH, 3SP, 3TJ, 3TT, 3UC, 3ABV, 3ACB, (3ACL), 3ACN, 3ACY, (3ADI), 3AEF, 3AEG, 3AFF, 3AGH, (3AGR), 3AIF, 3AIG, 3AIP, 3AIR, 3AIU, (3ALH), 3ALU, (3AMK), 3AMQ, 3AMR, 3ANO, 3AOJ, 3APN, 3AQE, 3AQM, 3ARG, 3ARI, 3ASJ, 3ASK, (3AVP), 3AWZ, 3AXU, 3AYW, 3AZA, 3AZE, 3BCF, 3BKE, 3CA, 3CS, 3DCX, 3DFO, 3DFX, (3DKV), 3DNC, 3DQ, 3DRA, (3DTN), 3DUG, (3DWP), 3DYU, 3DYY, 3DZE, 3DZI, 3GY, 3HM, 3IY, 3KO, 3LF, 3ME, 3MC, 3NQ, 3NR, 3OX, 3PD, (3PM), (3PW), 3UH, (3VL), 3VM, 3WL, 3WT, 3XI, Can. 3GE, 3JL.

C.W.: 1ABY, 1BDC, 2AJF, 2FD (ICW), 3DH (ICW), 3FS, 4BY, 5KU, 5AR, 5AOG, 5AXK, 5BXA, 5CFP, 5EB, 5HJ, 5II, 5IQ, 5SP, 5UJ, 5UK, 5UY, 5WA, 5XV, 5ZAE, 5ASD, 5AXE, 5BLO, 5DWJ, 5HW, 5IO, 5NX.

9BER, Villisca, Iowa.

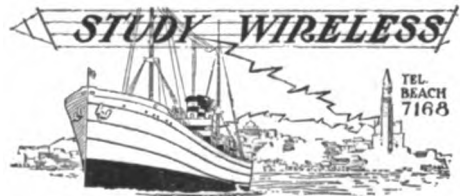
Spark: 4ED, 4ID, 4LT, 5ARR, 5BM, 5BY, 5DD, 5DF, 5EW, 5FO, 5HK, 5IF, 5IR, 5IS, 5MM, 5NR, 5OF, 5TG, 5TU, 5UC, 5XD, 5XI, 5XJ, 5XO, 5XU, 5YL, 5YM, 5YI, 5ZA, 5ZC, 5ZL, 5ZZ, 5ZAB, 5ZAK, 7ZO, 8AFD, 8BEP, 8BOX, 8BRL, 8BXC, 8XV, 8YM, 8YU, 8ZG, 8ZH, 8ZL, 8ZO, 8ZP, 8ZW, 8ZY, 8ZZ, 9ACB, 9ACY, 9AEG, (9AEQ), 9AEY, 9AFW, 9AGE, 9AIS, 9AJS, 9AJT, 9AKT, 9ALO, 9ALS, 9AMD, 9AMG, 9ANS, 9AOE, 9AOU, 9APN, 9AQE, 9ARA, 9ATN, 9AVC, 9AWX, 9AWZ, 9AYW, 9AYZ, 9AZA, 9BH, 9BAB, 9BDQ, 9BGG, 9BHS, 9BKG, 9BLK, 9CA, 9DBI, 9DBS, 9DFA, 9DHG, 9DHz, 9DIK, 9DKV, 9DKX, 9DMB, 9DMM, 9DNC, 9DPB, 9DPH, 9DQ, 9DSD, 9DUQ, 9DYM, 9DYS, 9DYU, 9DZI, 9EE, 9EX, 9GN, 9HI, 9HJ, 9HM, 9HT, 9IF, 9IL, 9IT, 9JG, 9LN, 9LW, 9MC, 9MR, 9NT, 9PZ, 9ST, 9TL, 9XU, 9XAF, 9YA, 9MP, 9NR, 9PI, 9RZ, 9ST, 9TL, 9XU, 9XAF, 9YA, 9YB, 9YC, 9YI, 9YM, 9YO, 9YQ, 9YAB, 9YAE,

9YAK, 9YAL, 9AM, 9YTK, 9ZC, 9ZJ, 9ZN, 9ZS, 9ZU, 9ZAA, 9ZAC.

C.W.: 4BK, 4BY, 4EL, 4FT, 4ID, 5KP, 5MT, 5XB, 5XJ, 5AQR, 5BOX, 5RV, 5ZQ, 5ZV, 5ZZ, 5AE, 5AU, 5ACO, 5AEJ, 5AKB, 5AKH, 5AKP, 5AKX, 5AMB, 5ANI, 5ARJ, 5ARK, 5AUA, 5AUS, 5AYS, 5BED, 5BIC, 5BIK, 5BJI, 5BMD, 5BOJ, 5BOQ, 5DY, 5DPE, 5DTH, 5DTW, 5EW, 5FM, 5HK, 5JL, 5NR, 5PI, 5XI, 5XAQ, 5XOQ, 5ZAE, 5ZAI, 5FI, 5DFI, 5XFI, 5XAI.

9XAQ, University of Colorado, Boulder, Colo.

C.W.: 3AQR, Can. 4CB, 4FT, 5AN, 5FV, (5XJ), (5XU), (5ZA), (5ZO), 5ZS, 5ZU, (5AIF), 5ALU, (5ATG), (5JD), 6XAD, 6XAF, 6XH, (6ZA), (6ZZ), 8AGL, 8AGZ, 8BO, 8BOX, 8BZJ, 8IV, 8VY, 8XV, (9AAO), 9AAP, 9AAS, (9AAU), 9AEJ, 9AJA, (9AJH), 9AKR, (9ALG), (9AMB), 9AVN, (9AYS), (9AYU), 9BAP, 9BAY, (9BBF), 9BEM, 9BEQ, (9BEX), 9BFE, 9BIG, (9BIK), (9BII), 9BJV, (9BOW), (9DCF), 9DFL, (9DJB), 9DOJ, 9DPE, (9DTH), (9DTM), (9DTW), (9DVA), 9DZQ, (9FM), (9HK), 9II, 9IL, (9JL), (9NX), 9PG, 9PI, 9QE, (9QL), 9RQ, 9SV, (9WD), 9WU), (9XAI), 9XI, 9XM, 9YY, (9YAC), (9ZAF), 9ZB, 9ZL, (9ZT).



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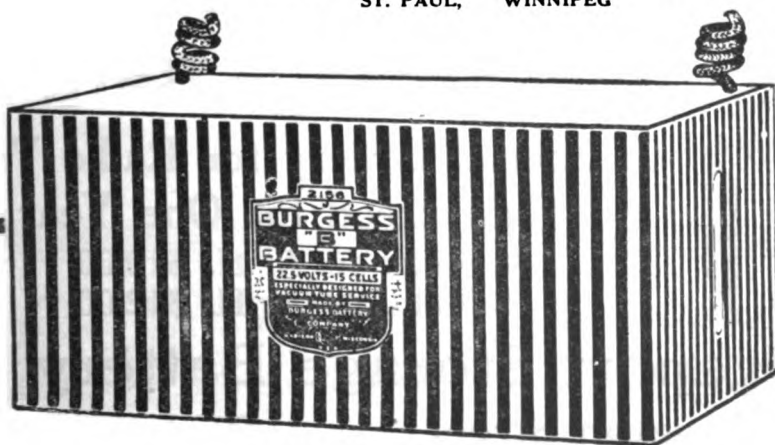
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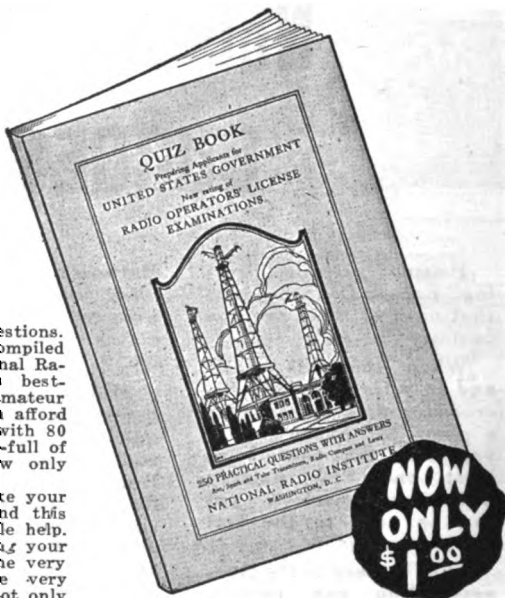
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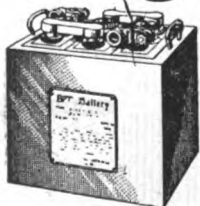
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# Bridgeport Storage Batteries



A Special Battery for Radio Work  
Guaranteed for One Year

6 Volts 40 A. H. \$10.00

6 Volts 60 A. H. \$12.00

## Bridgeport Storage Battery Co.

235 Remington Street

Bridgeport Conn.

# MURDOCK

## *radio necessities*

---



No. 56 Phones

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$4.50 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

*Buy Murdock apparatus from your dealer.*

---

# WM. J. MURDOCK CO.

**Another**



**Achievement**

# **the Telmacophone**

**Here is the height of Telmaco perfection.** Equipped with Baldwin Type C Unit, Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail.

Don't be misled into buying a loud speaker offered for less, and expect satisfaction; for a loud speaker of quality cannot be sold for less. Only after the most exhaustive tests and comparisons with the other loud speakers and only after the most thorough research, laboratory tests, and field demonstrations has the **Telmacophone** been perfected, and offered now, for the first time to the public.

**Telmaco Amplifiers, Receivers, Detectors, Variometers, and Variocouplers** have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the **Telmacophone**.



*No extras to buy.  
Nothing to get out  
of order.*

Price  
Complete \$20.00

Fully  
Guaranteed

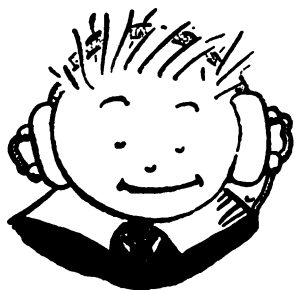
**If you haven't our complete catalog "P", be sure to write for it now.** Dealers! We are distributors for nearly all standard lines. Full discounts on the **Telmacophone**. Write for proposition on our complete line.

**RADIO DIVISION**

## **Telephone Maintenance Co.**

**17 N. LaSalle St.,**

**Chicago, Ill.**



**Read the "DIARY OF A HAM"**

Appearing Each Month in

### **"CANADIAN WIRELESS"**

(ONE DOLLAR A YEAR)

### **Scientific Experimenter**

LIMITED

**33 McGill College Avenue,**

Write for Catalog of Wireless Supplies

**Montreal, P. Q.**

# SHELL TYPE Transformers FOR C.W.



**The Superiority of Shell Type Transformers  
Is Recognized**

## FOR FILAMENT HEATING

| Capacity<br>Watts | Sec.<br>Volts | Unmounted | Price<br>Mounted |
|-------------------|---------------|-----------|------------------|
| 80                | 8.5           | \$6.00    | \$7.00           |
| 150               | 12            | 8.00      | 10.00            |
| 300               | 12            | 12.50     | 15.00            |

## FOR PLATE SUPPLY

| Capacity<br>Watts | Secondary Each<br>Side of Neutral | Unmounted | Price<br>Mounted |
|-------------------|-----------------------------------|-----------|------------------|
| 100               | 350 and 550                       | \$11.00   | 13.00            |
| 450               | 1000 " 1500                       | 16.00     | 18.00            |
| 900               | 1000 " 1500                       | 27.00     | 30.00            |

WE MANUFACTURE TRANSFORMERS DESIGNED FOR ONE  
5 WATT TUBE, WITH SECONDARY VOLTAGES OF 10 AND 650,  
BUILT SHELL TYPE, UNMOUNTED ONLY, PRICE \$7.50.

# Thordarson Electric Mfg. Co.

517 S. Jefferson Street,

Chicago

# FACTS WORTH READING !

## EXTRACTS FROM A STRANGER'S LETTERS

Craig, Alaska, 10/21/21.

Experimenters Information Service,  
45 Pinehurst Ave., New York.  
Gentlemen:

Received parts of your 160 to 1000 meter receiver, just completed the set and given same a few days tests.

Am very much pleased and wish to state that it is the best receiver I have ever worked. The latest commercial receivers (Navy Tuners) approach yours very closely in selectivity. Can copy stations 1000 miles distant thru interference by stations of equal power only 100 miles away, both tuned to 600 meters. Some of the Pacific Coast amateurs come in QSA without regeneration. Heartily recommend your BLUE PRINTS to anyone wanting a first class design.

(Signed) Winfield S. H. Wood.

Craig, Alaska, 11/22/21.

Experimenters Information Service,  
45 Pinehurst Ave., New York.  
Gentlemen:

On 600 meters I get everything on the Pacific Coast. Stations 1500 to 2000 miles come in very loud. I get ships and 1KW land stations in the Hawaiian Islands fine.

The best work of your receiver is in Phone work. After a few days' test I was able to get the Avalon Phone fine and since have heard them nightly and sometimes an hour before dark. After a few nights' adjustment was able to get the bulletins and music from the Fairmont Hotel in San Francisco. Next I picked up the music from the Post Intelligencer Office, Seattle. (Note: This phone is 10 watt Output). Have never heard this feat duplicated. Everything on one bulb.

(Signed) Winfield S. H. Wood.

The above receiver built from one of the 22 Blue Print Designs we produce. Inspect them at your dealer or write for new illustrated Bulletin S.

**EXPERIMENTERS INFORMATION SERVICE**  
45 PINEHURST AVENUE, NEW YORK CITY

STERLING  
9BGE

# MINNEAPOLIS

RADIO  
9BGE

**WE REPRESENT THE BEST IN RADIO**

| X BALDWIN X  |         | AMRAD                    |         | RADIO CORPORATION          |  |
|--------------|---------|--------------------------|---------|----------------------------|--|
| Type C       | \$12.00 | New Det. & 2 Stage Ampl. |         | C-W Equipment              |  |
| Type E       | 13.00   | New Regenerative Rec.    |         | One Combination Grid       |  |
| Type F       | 14.00   | Twin-R-Sinc Motor        | \$25.00 | Leak and Condenser With    |  |
| Type G       | 15.00   | Wavemeter                | 13.50   | Every Tube FREE!           |  |
| Speaker Unit | 6.00    | Bunnell Key              | 4.00    | UV200 \$5.00, UV201 \$6.50 |  |
| Headband     | .75     | Ampliformer              | 3.75    | UV202 8.00, UV203 30.00    |  |

WE ARE JOBBERS—DEALERS GET OUR PRICES—CATALOGUE 25c

**STERLING ELECTRIC CO., 33 So. 5th St., Minneapolis, Minn.**



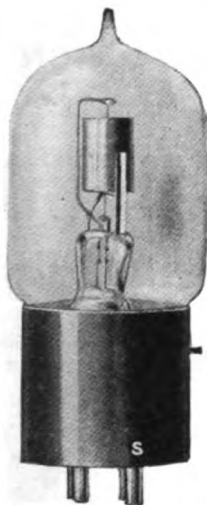
# Godley's message

With **A-P tubes** Paul F. Godley, American radio amateur, recently succeeding in receiving radio messages in England transmitted across the Atlantic from the U. S. After returning to America he telegraphed the A-P Co. the following message:

*"Your (A-P) tubes used exclusively in superheterodyne with excellent result tubes selected on this side remained intact and carried on throughout entire procedure also used your (A-P) tube as detector with this outfit"*

(Signed) GODLEY.

## A - P tubes hear across the Atlantic

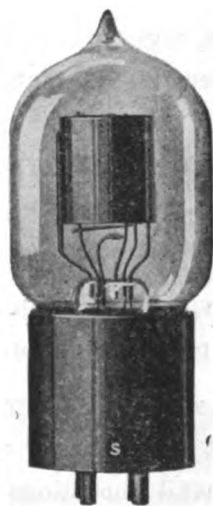


THE A-P VT  
AMPLIFIER  
OSCILLATOR

—the Amplifier used by the U. S. Navy. "Use the tube the Navy uses." Price—\$6.50.

Go to your radio dealer today. Place in your set *now* the A-P tubes used by Paul F. Godley. There is an A-P tube for every purpose. The A-P tubes here illustrated are the ideal combination for amateur use or home sets. "Use A-P tubes for efficiency." Use A-P tubes **exclusively**.

--the tubes  
t h a t a r e  
used by those  
who **KNOW**



THE A-P  
ELECTRON  
RELAY

—the most sensitive detector of spark signals known to the radio art. Price—\$5.00.

A-P tubes are licensed by the Radio Corporation of America under DeForest Audion and Fleming patents for amateur and experimental use in radio communication

### ATLANTIC-PACIFIC RADIO SUPPLIES COMPANY

Henry M. Shaw, President  
NATIONAL DISTRIBUTORS FOR THE MOORHEAD LABORATORIES, INC.  
638 MISSION STREET—SAN FRANCISCO—CALIFORNIA  
EASTERN OFFICE—5 KIRK PLACE—NEWARK, NEW JERSEY

# use A-P tubes for efficiency

# IRVINGTON

## Flexible Varnished Tubing



Superior high gloss appearance, in all colors and sizes, to fit all B. & S. gauge wires or special shapes for special conditions.

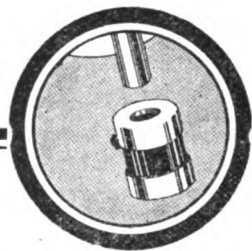
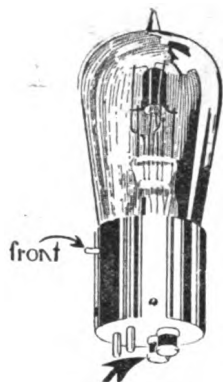
Its high Insulation Resistance, Dielectric Strength and Flexibility under all climatic conditions, makes it the superior insulation for all external and internal leads.

Irvington flexible Black Tubing is superior for all outside work.

Low prices and immediate shipment guaranteed. Size card samples and quotations on request.

Varnished Cambric, Insulated Papers and Compounds, now used in high grade wireless equipment.

**Irvington**  
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 Irvington, New Jersey



## Protection

of your bulbs against burning out is positively assured by the

# RADECO

## SAFETY FUSE

(Patent Pending)

can be used on any standard bulb used in any standard socket. Slips directly on filament terminals.

# 4 for \$1

Order by Mail or from your dealer

Carrying capacity  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$  and 3 amperes. Will also protect other delicate electrical instruments.

## Radio Equipment Co.

630 Wash'n St. Boston, Mass.

Boston's Oldest Exclusive Radio Store

## DEALERS!

Demand for the Radeco Safety Fuse, as you would expect, is strong and growing fast. It yields a tidy profit and brings trade to your store. Write today for Dealers Price List.

# PARAGON

THE

## Pioneer

- 1915 First regenerative receiver ever manufactured bore the name PARAGON.
- 1916 First Trans-continental Amateur Reception (California from New York; not pre-arranged) effected with a PARAGON Type RA-6 Receiver.
- 1916 First Trans-continental Amateur Transmission (New York to California; not pre-arranged) effected by PARAGON designed transmitter.
- 1917-1918 PARAGON acknowledged supreme on Western Front.
- 1921 First Trans-Atlantic Amateur Reception effected with PARAGON receiving equipment, at which time 27 different amateurs scattered thruout the Eastern section of the United States registered signals at Ardrossan, Scotland—3500 miles.

*THERE'S A REASON!*

2nd District Convention, Hotel Pennsylvania, March 7 to 11, 1922

## The Adams-Morgan Company

*Manufacturers*

UPPER MONTCLAIR, N. J.



## You Couldn't Buy This Knowledge—

**A**T each of the SORSINC offices there are thoroughly trained professional radio men who know from experience the past performance of each piece of apparatus.

Backed by the most complete stocks of the leading lines, these men can advise and help you in investing your money in radio equipment to your best advantage. It is well worth your while to take advantage of this service, and—it costs no more to buy from



We have just prepared an interesting little booklet illustrating the best apparatus on the market today. Fill in coupon and enclose 6 cents in stamps to pay postage on your copy.

**SHIP OWNERS**  
RADIO SERVICE INC.

80 Washington St., New York, N. Y.  
Branch Offices and Dealers Everywhere

**"THE LARGEST RADIO CHAIN STORE  
SYSTEM IN THE WORLD"**

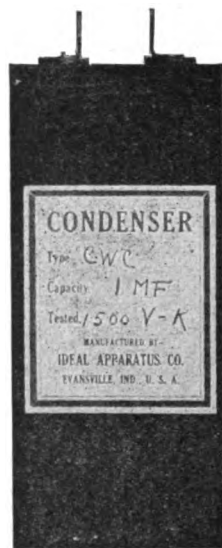
**DEALERS** Wire for Interesting  
Proposition

SORSINC, 80 Washington St., New York  
Herewith 6 cents in stamps to pay mailing  
expense on my copy of your latest booklet.

Q-3-2

# IDEAL

## FILTER CONDENSER



Type ICC

The Ideal Condensers have met with great favor in radio circles throughout the country, all because of their super-efficiency.

Recently designed to stand potentials of 2000 Volts without puncturing, and at no increase in price.

These attractively priced condensers may be obtained from any of the dealers listed below. They will furnish you with complete information regarding the IDEAL LINE.

1 Mfd 2000 Volt Condenser . . . \$2.00  
2 Mfd 500 Volt Condenser . . . 1.50

Somerville Radio Lab., Boston, Mass.  
Benwood Company, Inc., St. Louis, Mo.  
Pitt. Radio & Appli. Co., Pitts., Pa.  
Hemple Electric Co., Omaha, Nebr.  
Klaus Radio Co., Eureka, Ill.  
Standard Radio Co., Los Angeles, Calif.  
Nola Radio Co., New Orleans, La.  
John R. Koch, Charleston, W. Va.  
Cino Radio Mfg. Co., Cincinnati, O.  
T & H Radio Company, Anthony, Kansas  
Wireless Mfg. Co., Canton, Ohio  
Northern Radio Co., Seattle, Wash.

**C-W CATALOG FREE  
IDEAL APPARATUS COMPANY  
EVANSVILLE,**

**"9XAH" INDIANA "9XAH"**



Confucius has said:  
"The accomplishment  
of great things  
consists  
In doing small things  
Well."  
Perfection of  
detail

makes the  
Grebe Receiver  
What  
it is -

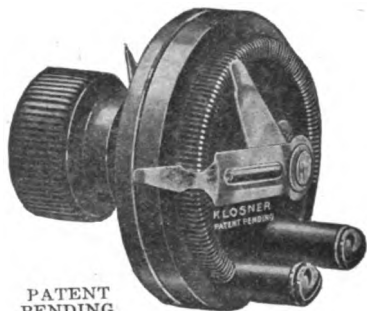


Licensed under  
Armstrong U. S. Patent  
No. 1,113,149

The Grebe CR-5 Receiver

GREBE RADIO  
Doctor Wfu.

# KLOSNER VERNIER RHEOSTAT



PATENT  
PENDING

## FOR THE MODERN CRITICAL TUBE

The first and only rheostat made  
having but

## ONE SINGLE KNOB

for both rough and fine adjustments

## SIMPLE QUICK POSITIVE

Highly finished Condensite base and  
knob. Phosphor bronze contact  
springs. All metal parts polished  
nickle plated.

Diameter only  $2\frac{1}{8}$  inches.

**PRICE ONLY \$1.50**

ADD SHIPPING WEIGHT ONE POUND

Get it at your dealer or send direct  
to us. Sold on a satisfaction or money  
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*Dealers — Jobbers — Manufacturers:  
Write immediately for attractive  
proposition.*

**Klosner Improved  
Apparatus Company**

Dept. Q.

2404 Crotona Avenue, N. Y. City

# EVERYTHING Radio!

**WE** carry complete  
stocks of the follow-  
ing companies:

**Radio Corporation**

**Westinghouse**

**A. H. Grebe**

**Remler Manufacturing  
Company**

**E. T. Cunningham**

**Radio Distributing Co.**

**W. J. Murdock Company**

**Federal Telephone & Tel-  
egraph Co.**

**F. A. D. Andrea**

Send for booklet "Q" en-  
closing six cents in stamps to  
cover postage.

*Jobbers and Dealers in Radio.*

## PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY



1533 PINE STREET, PHILADELPHIA

# The Most Popular Radio Insulation

Week by week the amount of Formica used for radio insulation by amateur and commercial operators increases. It is the most popular material of its kind. This great demand for Formica is due to its high dielectric strength, and the low power and hysteresis losses with high frequency currents where it is employed.

It is due also to the handsome, good looking panels that Formica makes and to the fact that it machines easily. It is unaffected by weather conditions, oil, water, acids, alkalis. It retains its good looks and high efficiency indefinitely.

Formica is approved by the United States Navy and the Signal Corps!

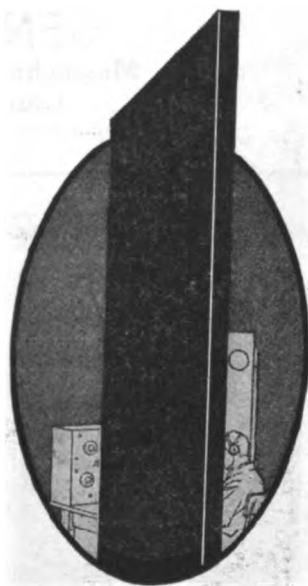
*Dealers: We co-operate to increase your Formica sales. You can buy Formica in 36" x 42" sheets and cut it yourself or we will cut it into any series of standard sizes that you want at a small extra cost. Write for our dealer helps. Let us send you electro-types for your local newspaper advertising.*

**THE FORMICA INSULATION CO.**

**4620 Spring Grove Avenue,**

**Winton Place,**

**Cincinnati, Ohio**



# FORMICA

Made from Anhydrous Redmanol Resins

## SHEETS TUBES RODS

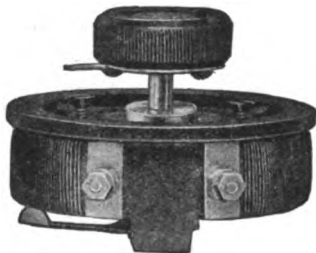


## YOUR EXPECTATIONS SATISFIED

When you purchase instruments from magazine advertisements, are your expectations always satisfied?

The General Radio Company has been supplying the leading research and technical laboratories of the country with radio instruments for many years. Our instruments must justify our statements. Every instrument is guaranteed.

When you are interested in radio instruments, why not purchase those which have met with the approval of the leading radio engineers of the country? If you desire instruments for accurate research measurements, we can supply them. If you desire the best working instruments for your radio set, we can supply them.



### FILAMENT RHEOSTAT

If you want a rheostat which has smooth operation—without grating or clicking, which is rugged, and which is attractive in appearance, examine the merits of our Type 214. This rheostat is made in two sizes, 2.5 amperes for transmitting tubes and 1.5 amperes for receiving tubes. Both sizes are made in back-of-panel or portable mountings.

Price - - \$2.50

This is just one instrument of our complete line. Examine them all.

*Send for Free Radio Bulletin 910Q*

## GENERAL RADIO CO.

Massachusetts Avenue and Windsor Street  
Cambridge 39 Massachusetts

*Standardize on General Radio Equipment Throughout*



**BINDER WITH TWO CLIPS**  
**POSTPAID—\$1.50**

There is only a limited supply of these binders on hand, which we will furnish for \$1.50 apiece, with two clips, postpaid. Act NOW and avoid disappointment. Address your order and make your remittance payable to

**THE AMERICAN RADIO RELAY LEAGUE, HARTFORD, CONN.**

## QST Readers!

Your set looks better and works easier in a cabinet than it does strewn all over a table, doesn't it? Right!

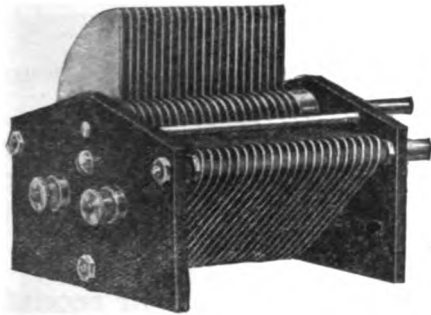
Your copies of QST are as valuable to you as your pet pieces of "junk." Of course!

You no longer have to stack your magazines in an unhandy pile, or scatter them around where the copy you most wanted to keep will likely get lost. We are illustrating herewith the "QST Cabinet," a binder especially made up for preserving your QSTs, keeping them clean and together in order for quick and easy reference.

The QST binder is in dark red with gold "QST" on back and front. To mount your QSTs, just punch two holes through the binding edge of the magazines, string them on the two clips we furnish, and fasten through the eyelets shown in the cut.

# CESCO Amplifier, \$12.50

## Variable Condenser with binding posts for \$2.10



The CESCO 1-Stage amplifier, as shown below, is a winner and a wonder at the price. Neat, compact, durable, efficient, and beautifully finished. Made of XX Bakelite, the tube socket of the 4-prong type to accommodate any standard up-to-the-minute tube. General Radio amplifying transformer, Remler rheostat, and Murdock socket—standard parts, which in the careful process of CESCO manufacture brings it up to the prevailing high quality of other CESCO apparatus, and following the usual CESCO policy, marked at a price which makes it the best buy on the market. Every one fully guaranteed. Price, mailed postpaid to any address in the U. S., \$12.50.

The "Pen Brand" variable condenser has been developed to meet the needs of advanced radio for a more efficient and more convenient condenser at a lower price. The "Pen" has two binding posts to which connection can be made without soldering, the only unmounted condenser manufactured with binding posts. Another exclusive feature of the "Pen" condenser is a special adjusting screw, by means of which the plate adjustment can be stiffened to prevent the variable plates from slipping after the desired wave length has been secured. The best condenser of this type at any price, and priced the lowest of any.

3 plate—\$2.10    11 plate—\$2.60  
23 plat—\$3.45    43 plate—\$4.60

*"Radio Supplies  
that R  
right"*



Mail your orders at once. Don't delay. The demand for this apparatus is big, and we cannot promise prompt delivery to meet the demand of both wholesale and retail trade unless orders are mailed promptly. CESCO guarantees the quality. The price speaks for itself. Enough said.

CALIFORNIA ELECTRIC SUPPLY CO.  
643 MISSION STREET, SAN FRANCISCO, CALIFORNIA

## Radio Supplies That R Right

# ANNOUNCEMENT

## Radio Material

## Radio Service

We wish to announce to the Radio Public that we carry in stock a complete line of Radio Material and Apparatus.

It is our desire to place before the vast number of radio men throughout New England a store with SERVICE.

Our mail order department is ready to make prompt shipments on orders received the same day. Hartford, the center of radio activity, will be now in a position to render SERVICE to all interested in this fascinating study.

Our 1922 Radio Catalogue is ready for mailing on receipt of five cents in postage.

**Stern and Company, Inc.**

*Wholesalers  
Retailers*

308 ASYLUM STREET,

HARTFORD, CONN.

# RADIO APPARATUS

## LARGEST STOCK SOUTH PROMPT DELIVERIES

### SERVICE

|  |        |
|--|--------|
| B. Batteries Radisco Small 22½ V. ....         | \$1.50 |
| B. Batteries Radisco large-tapped 22½ V. ....  | 2.65   |
| B. Batteries Eveready large-tapped 22½ V. .... | 3.00   |
| Tubes UV200 Radiotron Detector .....           | 5.00   |
| Tubes UV201 Radiotron Amplifier .....          | 6.50   |
| Tubes UV202 Radiotron Trans-5 watt .....       | 8.00   |
| Tubes UV203 Radiotron Trans. 50 watt. ....     | 30.00  |
| Tubes C300 Cunningham Detector .....           | 5.00   |
| Tubes C301 Cunningham Amplifier .....          | 6.50   |
| Tubes Electron Relay Detector .....            | 5.00   |
| Tubes A & P Amplifier .....                    | 6.50   |
| Phones Murdock 2000-ohm .....                  | 4.50   |
| Phones Murdock 3000-ohm .....                  | 5.50   |
| Phones Brandes Superior .....                  | 8.00   |
| Phones Brandes Navy .....                      | 14.00  |
| Phones Baldwin Type C .....                    | 12.00  |
| Phones Baldwin Type E .....                    | 13.00  |
| Phones Baldwin Type F .....                    | 14.00  |

### QUALITY

|                                    |        |
|------------------------------------|--------|
| Sockets Paragon .....              | \$1.00 |
| Sockets Murdock .....              | 1.00   |
| Sockets G. A. ....                 | 1.50   |
| Sockets DeForest .....             | 1.20   |
| Rheostats Paragon .....            | 1.50   |
| Rheostats DeForest .....           | 1.65   |
| Rheostats Gen. Radio .....         | 2.50   |
| Rheostats Remler-Jr. ....          | 1.00   |
| Remler Rheostat .....              | 1.50   |
| Rheostats Parkin .....             | .75    |
| Corwin Dial & Knob 3" .....        | 1.00   |
| Corwin Dial & Knob 3½" .....       | 1.20   |
| Dial and Knob Chelsea .....        | 1.00   |
| Transformers, Acme Unmounted ..... | 4.50   |
| Transformers, Acme Sem-mtd. ....   | 5.00   |
| Transformers, Acme Mounted .....   | 7.00   |
| Transformers, Federal .....        | 7.00   |
| Transformers, UV712 .....          | 7.00   |

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

Acme Apparatus  
Clapp-Eastham  
DeForest  
Wm. Murdock

Federal  
Firth  
Radio Dist. Co.  
Radio Corp.

Brandes  
Adams-Morgan  
Chelsea  
Magnavox

Remler  
Signal  
Eveready  
N. Baldwin Co.

## ROSE RADIO SUPPLY

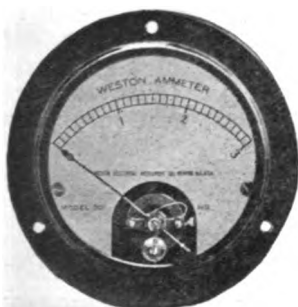
604 GRAVIER STREET,

NEW ORLEANS, LA.

Send 10c for Catalog



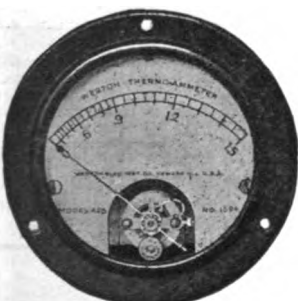
**Filament Voltmeter**



**Filament Ammeter**



**Plate Voltmeter**



**Antenna Ammeter**

# Follow the Expert Don't Blame the Tube !

If a tube fails to give the results you expect, the fault is probably your own. NO ONE can secure maximum tube life or obtain the most perfect results if control is by guess-work. Tubes function to the best advantage within exceedingly narrow limits of voltage, and there is no possible way of keeping the filament voltage within these limits except by using a thoroughly reliable voltmeter.

## Follow the Advice of Experts

When manufacturers of tubes state with unmistakable emphasis that precise control of filament voltage enormously prolongs the life of receiving, amplifying and transmitting tubes and increases their efficiency;

When every conscientious dealer who has your and his own best interests at heart recommends that you prolong tube life by use of electrical measuring instruments;

When all commercial radio workers invariably use instruments for a variety of purposes—

**WHAT REASON HAVE YOU FOR BELIEVING YOU ARE THE EXCEPTION AND CAN GET GOOD RESULTS AND MAXIMUM TUBE LIFE WITHOUT A VOLT-METER?**

The fact of the matter is you cannot do so; why then postpone investigation of this subject? Why continue to face certain tube replacement expense and inferior results?

**Send today for Weston Circular "J". This circular contains a complete description of a large variety of instruments for Radio Service.**

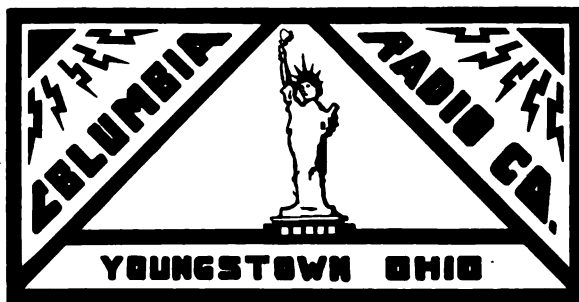
## **Weston Electrical Instrument Co.**

**158 Weston Ave.,**

**Newark, N. J.**

**BRANCH OFFICES IN ALL LEADING CITIES**

AMPLIFICATION



AMPLIFICATION

## RADIO FREQUENCY

Experimenting on our new radio frequency amplifier is now finished and the instrument will soon be on the market and at a price that you cannot afford to be without one. As everyone knows, radio frequency is THE amplification and gives dependable results.

## AUDIO FREQUENCY

On our audio frequency amplifier we use a high ratio transformer on the first stage, grid potential on the amplifier tubes, binding posts for use of same or separate storage and B batteries, in fact nothing is left out that improves amplification.

*Write for full information.*

**If it's COLUMBIA it's AMPLIFICATION**

# PATTERNS

## Something New In Radio

In building a Radio apparatus the lack of mechanical knowledge often handicaps the amateur in such a way that the instrument he builds has not the standard made appearance which is desirable in any Radio apparatus. In order to remedy this, and give the amateur a chance to turn out an efficient and handsome looking instrument, we have designed a special set of patterns enabling anyone to make a standard receiver with all the improvements that can be found in expensive ready-made apparatus.



One of the foremost Radio engineers has constructed this set for us, specially for the amateur, and by our modern, novel methods of construction, anyone is able to make an efficient apparatus for the reception of wave-lengths up to 800 meters.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9x12".

The set consists of two blue prints, size each 19x21 inches and a four page 9x12 in. direction-pamphlet.

No. 1. Complete pattern for short wave regenerative set each prepaid

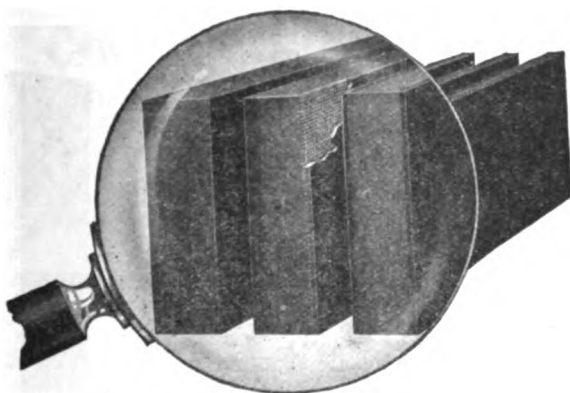
**50c.**

**Complete short wave regenerative set.**

**FOR SALE IN ALL GOOD RADIO STORES**

*If your dealer cannot supply you, send your order to us.*

**Consolidated Radio Call Book Co., Inc., 98-100 Park Place, New York City**



# panels

*Three distinct and exclusive types*

**C**HOOOSE the panel best suited to your needs and made to your own individual specifications. Any size or shape you desire—any quantity, one to a thousand—engraved or plain—polished or dull mat surface—plain blank or fully machined and ready for mounting. Diamond F Radio Panel Service gives you the choice of three distinct types of panels, each a leader in its field.

## CONDENSITE CELORON

Grade 10 is the highest type radio insulation made. Extremely high in surface and volume resistivity, high in dielectric strength and low in dielectric losses. It is handsome in appearance, extremely water resistant, machines easily, and will give long lasting, satisfactory service.

## CELORON FIBRE-VENEER

(patent applied for) is made of a hard fibre center section veneered on both sides with Condensite Celoron Grade 10. It meets the demand for quality plus low cost. We recommend it for use in receiving sets and other apparatus where very high voltages at radio frequencies are not involved. It has the same fine surface as grade 10 and similar machining and engraving qualities.

## CELORON SHIELDED PLATES

(patent applied for) are made with a concealed copper wire mesh imbedded directly under the back surface of the plate. This wire shield, when properly grounded, very effectively neutralizes all detuning effects and "howl" caused by body capacities. This type of plate is made in both Condensite Celoron Grade 10 and Celoron Fibre Veneer.

## *Send For Our Radio Panel Guide*

Write to day for our special "Radio Panel Guide", giving complete details regarding all Celoron Radio Panels. This guide quotes prices and enables you to determine just how much any type of Celoron panel will cost in either standard or special size—plain or fully machined, and engraved to your own specifications. Don't fail to get your copy of this important Guide by return mail. Write us immediately. *Dealers:* Our Radio Panel Service enables you to sell panels completely machined and finished to the buyers specifications. No waste. Write for our Special Dealers Proposition.

## DIAMOND STATE FIBRE COMPANY

Bridgeport (near Philadelphia) Penna.

Branch Factory and Warehouse, Chicago.

Offices in Principal Cities

In Canada: Diamond State Fibre Co. of Canada, Ltd.  
Toronto.

# ANNOUNCING The "Q-R" Vernier Adjuster Price \$1.50

At last you may secure a perfect micrometer adjustment for CW and Phone work and practically eliminate capacity effect from the hands. Easily attached in a few minutes without removing the panel and works on any type of dial.



Pat. Appd. For

OUR PROPOSITION TO DEALERS IS INTERESTING

## ROBINSON SPECIALTY COMPANY

13 WALNUT STREET, "YOUR DEALER HAS THEM" KEYPORT, N. J.

# WIRE PRICES SMASHED

No. 14 Copper Aerial Wire  
35c per lb.

| No. | Enamel | S.C.C. | D.C.C. | S.S.C. |
|-----|--------|--------|--------|--------|
| 20  | .19    | .24    | .25    | .39    |
| 22  | .21    | .28    | .30    | .40    |
| 24  | .23    | .29    | .32    | .41    |
| 26  | .25    | .32    | .36    | .50    |
| 28  | .28    | .36    | .39    | .55    |
| 30  | .30    | .47    | .50    | .58    |
| 32  | .33    | .60    | .63    | .75    |
| 34  | .34    | .86    | .90    | .88    |
| 36  | .35    | 1.17   | 1.26   | —      |

These prices for ¼ lb. spools. ½ lb & 1 lb. spools, proportionate prices. These prices are net and include spools and postage. We carry all sizes, and all forms of insulation. Liberal discounts in quantity lots. Dealers write.

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A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

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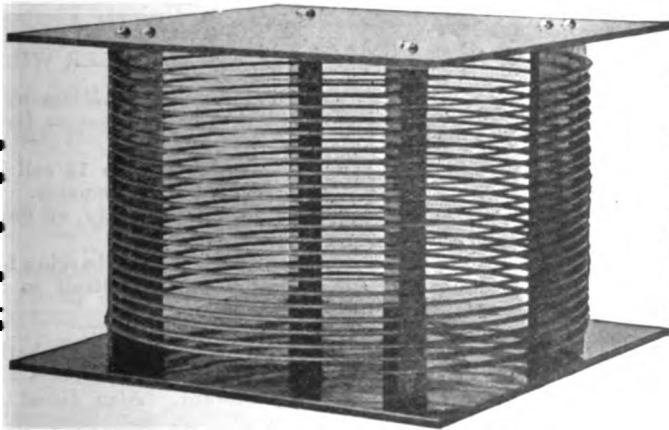
328 Broadway,

New York



**C-W C-W C-W C-W C-W C-W C-W C-W**

**CW Filters**  
**CW Plate Transformers**  
**CW Condensers**  
**CW Filament Transformers**  
**CW Iron Core Chokes**  
**CW Radio Frequency Chokes**



**CW Power Tubes**  
**CW Rectifier Tubes**  
**CW Sockets**  
**CW Rheostats**  
**CW Microphones**  
**CW Tone Arms**  
**CW Modulation Transformers**

**WIMCO CW 100 INDUCTANCE**

Get the **BEST CW Inductance**. Real connection clips provided, no uncertain switches which short circuit turns. Entirely insulated on Formica, high conductivity copper, very efficient. Made in 25 and 50 turn sizes, priced at \$10.00 and \$13.50 respectively. Also sold in parts ready to assemble.

We distribute the only complete line of panel type meters in America—Thermoammeters, AC and DC Voltmeters, Ammeters and Milliammeters. You can now equip your set with a complete set of meters all alike.

Big line of high voltage generators and motor-generators reasonably priced—just what you have been looking for.

## **SPECIAL NOTICE**

Grid coils for the above CW Inductance are now supplied so that the circuit described in July QST can be employed—and take it from us it is the **REAL** amateur circuit. Grid coil for the CW 100 Inductance priced at \$2.00. Ask for our new bulletin containing full dope on this circuit—try it on your own set, it's a winner.

## **Antenna Specials**

Now is the time to remodel your antenna and we are especially prepared to supply your needs in solid copper, stranded copper and copper-weld aerial wire.

### **Ask about the New Air Gap Type**

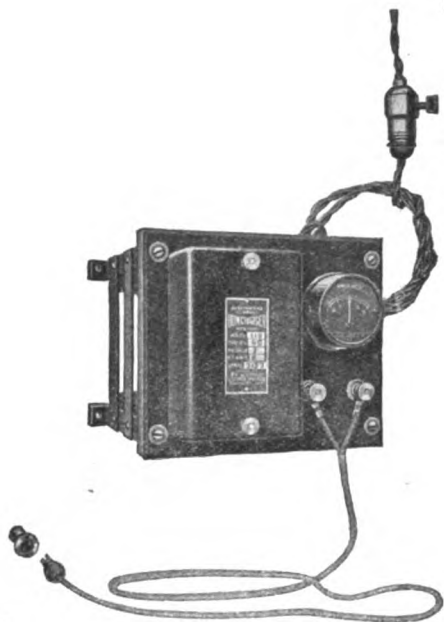
Antenna Insulators—wonderful for CW—priced right—positively superior to present forms and materials.

Send for special Antenna Material Bulletin or send 15c in stamps for catalog and complete literature.

**8ZV WIRELESS MANUFACTURING CO. 8ZV**

**CANTON, OHIO**

**WIMCO apparatus is distributed in Canada by Ontario Radio Laboratory,  
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THE HOMCHARGER WILL—

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3. Double the life of your battery.
4. Eliminate all charging bills and thereby pay for itself in a short time.

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PRICE F.O.B. LOS ANGELES OR  
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**SPECIAL THIS MONTH**

Bakelite Cut any size— $\frac{1}{8}$ ,  $\frac{1}{4}$ , and  $\frac{3}{8}$ , 1  $\frac{1}{2}$ c, 2c and 2  $\frac{1}{2}$ c per square inch.  
Mail Orders Promptly Filled.

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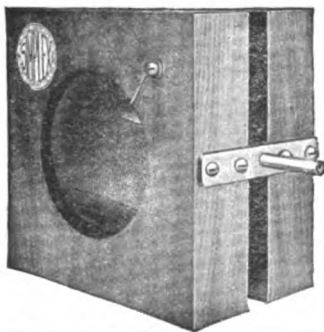
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"Pittsburgh's Radio Shop"

Exclusive 8th District Distributors for  
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These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base.

Variometer as illustrated ..\$6.00  
Vario-Coupler as illustrated 6.00

Round or Square Base

Get them at your dealer's.

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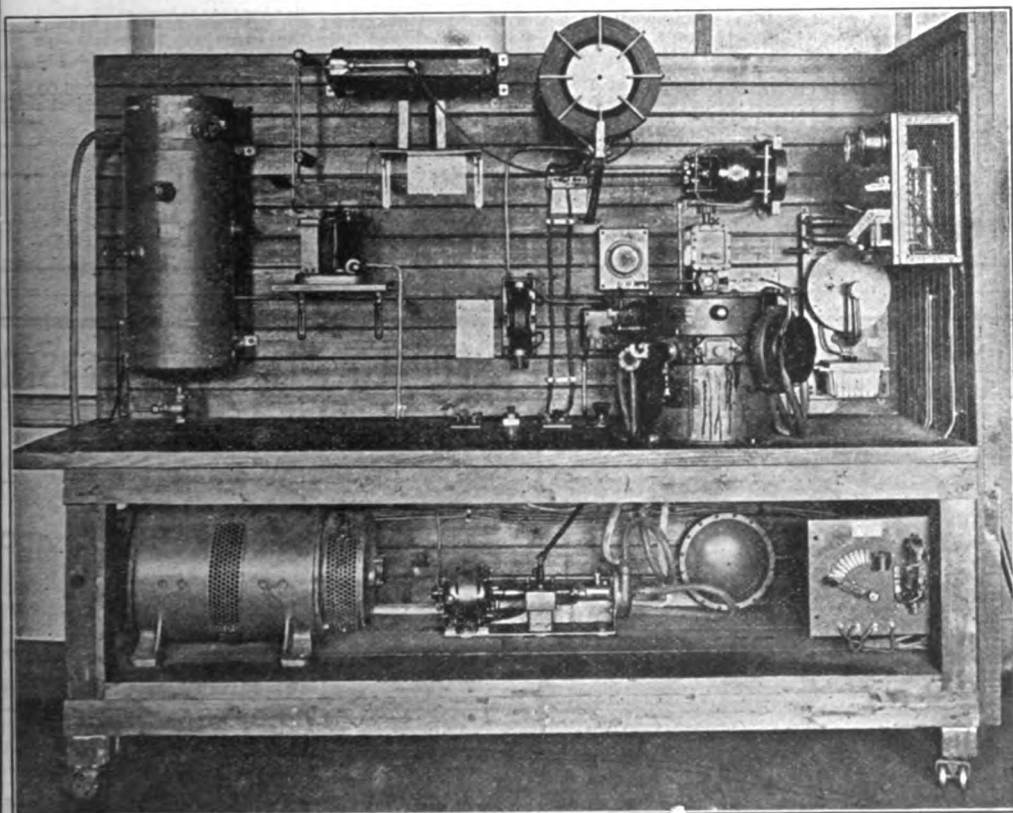
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The Revised Examination for Commercial Operators including ARC and VACUUM TUBES is carefully and fully covered by the Course of Instruction offered by the EASTERN RADIO INSTITUTE.

Intelligent students INSIST on being taught upon ACTUAL apparatus!



### **"The EASTERN RADIO INSTITUTE'S 2 K.W. 'ARC' "**

The EASTERN RADIO INSTITUTE is the OLDEST, LARGEST and BEST EQUIPPED Radio school in New England. The Pioneer school that has always led the way! Ask any man in Radio—he will tell you!

New Students can begin to advantage in the Day or Evening school on any Monday.

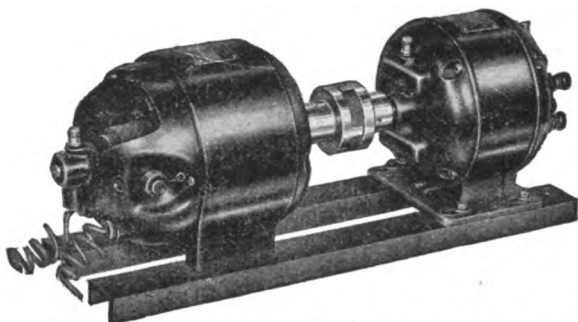
REMEMBER:—Our ORGANIZATION with YEARS OF PHENOMENAL EXPERIENCE and SUCCESS is behind every man who enrolls! Ask any man in Radio—he will tell you! OVER 4000 satisfied graduates TELL OUR STORY BEST! Why not be one?

Our illustrated prospectus is free. If you cannot visit the Institute send for one.

**F. D. PITTS Director**

# The Benwood Motor Generator

MADE FOR RADIOFONE & C.W. WORK



600 volts  
Has 82 segments in commutator, an exclusive feature. Cuts the familiar "hum" down to absolute minimum.

## SPECIFICATIONS

MOTOR—1-3 hp. Runs at 1750 RPM, 110 volts, 60 cycle. Exceptionally easy running, induction type. Motors for all other standard voltages and frequencies in stock either AC or DC. GENERATOR—A great deal of thought and effort has been given to this piece of apparatus and it is the finest that has ever been manufactured for radiophone or continuous wave work. There are 84 segments in the commutator (exclusive feature). The generator is very conservatively rated at 200 watts. It will easily

stand a 300 watt load with no appreciable heating. The machine under actual load gave the following results, which are quite remarkable:

|                            |           |
|----------------------------|-----------|
| Running Cold, No load..... | 610 volts |
| Under 50 watt load.....    | 580 volts |
| Under 100 watt load.....   | 550 volts |
| Under 150 watt load.....   | 530 volts |
| Under 200 watt load.....   | 520 volts |
| Under 250 watt load.....   | 510 volts |
| Under 300 watt load.....   | 500 volts |

This complete outfit is fully guaranteed for a two year period against all electrical and mechanical defects. It is of the highest grade workmanship throughout and only the very best materials are used in its construction. We specialize on this one size only, thus we are enabled to quote the attractive price of \$95.00 complete.

The motor or generator can be purchased separately. Generator only, \$55.00; Motor only, \$35.00 While we cannot guarantee the generator against electrical breakdown, many stations are driving the machine at 3400 RPM. to obtain 1100 volts for the 50 watt tubes.

Send ten cents for the NEW BENWOOD LOOSE LEAF CATALOG—Contains all necessary information concerning RADIO FREQUENCY.—Shows all the new BENWOOD wireless telephone apparatus.

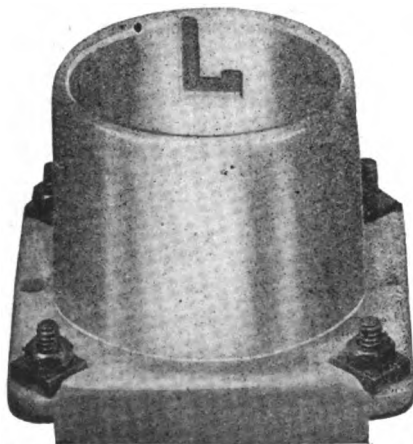
## THE BENWOOD CO., Inc.

1110 Olive Street,

St. Louis, Mo.

## The Original - At The New Price

50 cents each



The original socket with the concealed bayonet slot.

The old adage: "Imitation is the sincerest form of flattery" still holds!

Ask Your Dealer or Write Direct to:

**JOY and KELSEY**

4021 West Kinzie St.

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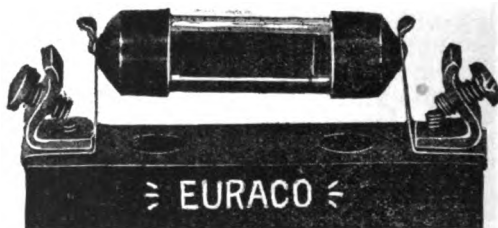
Illinois

## "EURACO" MICA CONDENSER

PRICE 60 CENTS

(.000025, .0001, .00025, .0005 MFD)

Designed to Fit Standard Grid Leak Base



Composed of Copper & Mica, Hand Made  
Compact, Interchangeable, Most Efficient

Bakelite Base with Single Mounting..\$0.40

Bakelite Base with Double Mounting.. .60

Bakelite Base with Triple Mounting.. .80

Interesting Proposition for Dealers

WE HANDLE ALL STANDARD APPARATUS  
PROMPT SHIPMENT—ALL GOODS SENT POSTPAID

## EUROPEAN RADIO CO.

Mfrs. of Multi-Stage Amplifiers, C.W. & Special Apparatus

1342 East 22 St., Brooklyn, N. Y.



## **THE STROMBERG-CARLSON No. 2-A RADIO HEAD SET**

These Stromberg-Carlson Radio Head Sets reproduce vocal or musical sounds with unequalled distinctness. Fine tonal qualities and extreme sensitiveness, even to weak signals, are features of this high-grade piece of apparatus.

For the past eight years its makers have been recognized leaders in manufacturing professional Radio Head Sets. Back of that is twenty-eight years service in building voice transmission apparatus for telephone companies. Stromberg-Carlson Telephone Receivers and Radio Head Sets are known in every part of the world where telephones and radio stations are installed.

This wide experience has enabled us to produce a new perfected Radio Head Set combining these important requirements:

### **SENSITIVENESS**

Spools wound with commercially pure small gauge copper wire—this reduces maximum effective ampere turns. Total resistance of set 2000 ohms.

### **COMFORT**

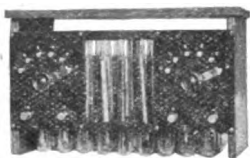
The head band and ear caps are light and correctly shaped. Covered with durable olive brown webbing.

### **CONVENIENCE**

Removable spring stirrups on the head band and forked cord construction permit quick separation of the receivers thus allowing simultaneous use of the Head Set by two people. Swivel adjustment insures quick and easy fitting to any shape or size of head.

If your dealer is not yet equipped with the Stromberg-Carlson No. 2-A Radio Head Set, order direct from us. Price \$7.50.

**Stromberg-Carlson Telephone Manufacturing Company**  
Rochester, N. Y.



# Storage Batteries

Designed Especially For

## WIRELESS



*"Cheapest in the long run"*

### KICO "B" BATTERIES

KICO storage "B" batteries will end your "B" battery troubles. YEARS of Real service, saving you money in the end. One charge lasts from three to six months while in your detector plate circuit. Short-circuiting, overcharging or standing idle DOES THEM NO HARM. Durably constructed of the best materials and highly finished making a piece of apparatus which will fit in any station. Can be charged from your A.C. line in one hour after the first charge which takes about four hours. All batteries are supplied with chemicals, rectifiers and directions for setting up. One quart of distilled water puts your battery into service. Money back if unsatisfied within three months trial. Prices as follows

|                | Plain  | With Panels |
|----------------|--------|-------------|
| 24 cells 32 V. | \$6.00 | \$11.00     |
| 36 cells 48 V. | 10.00  | 13.00       |
| 50 cells 68 V. | 12.00  | 16.00       |

### KICO "A" BATTERIES

No more ACID EATEN rugs or furniture. Truly a PARLOR battery, designed especially for wireless den, yet sturdy enough to kick over starter on Ford, Chevrolet or any car taking a battery 9"x7". Box and jars moulded in one piece from ACID-PROOF composition much tougher than hard rubber. A Box that will NOT crack, break or leak in battery use. 6 volt 80 to 100 A.H. capacity, guaranteed for 18 months but will last for years if used only for wireless @ \$24.00

We also manufacture the following sizes designed especially for C.W. work, assembled in especially treated, durable hard wood boxes with hard rubber jars and covers with deep sealing space, sealed with great care to prevent leakage. Guaranteed 18 months.

|                     |         |
|---------------------|---------|
| 6 volt 80-100 A.H.  | \$20.50 |
| 8 volt 80-100 A.H.  | 27.00   |
| 10 volt 80-100 A.H. | 33.00   |

Batteries shipped fully charged ready for use with hydrometer and full instruction for upkeep. Special sizes built to your specifications.

*Circulars furnished upon request.*

**KIMLEY ELECTRIC CO., 290 Winslow Ave., Buffalo, N. Y.**

# ACME

## C.W. APPARATUS

Has stood the test of time. Less than one instrument in every thousand that Acme has made has come back for replacement, or even repairs.

Take the uncertainty out of C.W. by using Acme apparatus throughout.

There is an Acme instrument for every C.W. need.

Get an Acme bulletin at your dealers or direct from us.

**Acme Apparatus Co.**

194 Massachusetts Ave.,  
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## Using An Inefficient Radio Set Is A Disappointment

We won't disappoint you because we handle the things that are really worth while in Radio. Our stock includes receiving and transmitting apparatus desirable for Spark, C.W. and Phone made by:

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| Grebe        | Pacent        |
| Westinghouse | Cunningham    |
| Acme         | Tuska         |
| Burgess      | Federal       |
| Magnavox     | Clapp-Eastham |
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Pioneer makers of Andrae Telephones. In business 60 years.

Our service is of the best and the quality of our goods unquestionable. Identified with telephone and electrical development of the Northwest since its beginning.

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*Distributors of Reliable Radio Apparatus to Dealers, Schools, Colleges, Radio Clubs and Experimenters All Over the World!*

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**SERVICE DISTRIBUTES  
"RADIO CORPORATION'S"  
PRODUCTS ALL OVER  
THE WORLD! TRY US  
AND SEE!**



## "PITTS CO"

**NOW HAS TWO STORES!  
BOTH CARRY "RADIO  
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PLETE LINE. ORDER TO-  
DAY FROM THE NEAREST!**

### RADIO CORPORATION'S PRODUCTS

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| No. UV-200 Radiotron, Detector .....   | \$5.00 |
| No. UV-201 Radiotron Amplifier .....   | 6.50   |
| No. UV-202 Radiotron 5 watt tube .....   | 8.00   |
| No. UV-203 Radiotron 50 watt tube .....  | 30.00  |
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| No. UT-502 End-mountings for UV-204 .....  | 2.50   |
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| No. UT-541 Porcelain Socket for UV-203 and UV-217<br>"Kenotron" tubes .....                      | 2.50   |
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| No. UV-217 150 watt "Kenotron" tube .....  | 20.50  |
| No. UP-1368, 325 watt C.W. Transformer .....   | 25.00  |
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| No. UP-509 to UP-527 Grid Leaks .05 to 5 megohms,<br>each .....                                  | .75    |
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| Note—Radio Corporation's C.W. Instruction Book giving<br>hookups, and complete information ..... | .25    |

**"LET 'PITTS CO' PRODUCTS, SUPER-SERVICE, AND DELIVERY SOLVE  
YOUR RADIO PROBLEMS"**

**SEND US YOUR ORDER TODAY!**

Send ten cents for Catalog No. 22. Over 100 pages, over 150 illustrations, over 600 items.

## F. D. PITTS CO., INC.

Branch—Woolworth Bldg.

12 Park Square, Boston, Mass. 193 Westminster St., Providence, R. I.

## Announcement!!!

The policy of the F. D. PITTS CO. has been and will be to render a "Superior Service", a Service based on carrying in stock for immediate delivery all desirable Radio apparatus, to serve our customers promptly and intelligently and to make them feel that we are truly grateful for their patronage.

In order to accommodate our ever increasing business we take pleasure in announcing the opening of OUR NEW STORE at PROVIDENCE, R. I. in the WOOLWORTH BLDG., at 193 Westminster Street, the very heart of the business section.

Mr. H. H. Tilley, a valued member of our organization will be in charge. His experience is wide and diversified, having in turn been an Amateur, Commercial Operator, Engineer, Instructor and Sales-Manager. You are cordially invited to visit our new store and experience real SERVICE.

If at any time you are interested in Radio to the extent of desiring instruction, Amateur or Commercial; Spark, Arc or Vacuum tube, let the EASTERN RADIO INSTITUTE train you—New England's, Oldest, Largest and Best equipped Radio School. For over six years I was Chief Instructing Engineer at this Institute, and I am in a position to know! Over 4000 satisfied graduates tell the story best! Our Organization with Years of phenomenal Results and Success is behind every man who enrolls.

F. D. PITTS

President and General Manager



# RAY-DI-CO Reduces Prices

Increased production and volume sales makes possible the most drastic price cut this year on Radio equipment. Ray-Di-Co's high quality, workmanship and materials are upheld.

ST 4                      -                      -                      -                      **\$64.75**  
40 Watt 350 Volt

ST 15                    -                    -                    -                    **\$97.50**  
150 Watt 500 Volt

ST 25                    -                    -                    -                    **\$138.50**  
250 Watt 1000 Volt

All motor generators are the four bearing type. The units are coupled together by means of flexible insulated couplings. Both units mounted on cast iron sub base insuring perfect alignment—armatures carefully balanced—no vibrations—large surface wick oiled bearing. Machine designed for continuous duty.

All standard Radio Equipment parts and accessories in stock.

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*Prompt attention given to Mail Orders.*

Established 1868



## THE ROSENBAUM<sup>CO</sup>

Pittsburgh, Pa.

We sell all standard apparatus from the best manufacturers. SEND US YOUR ORDERS from your catalogues.

Purchases delivered free to your nearest Shipping Point. Prompt Service.

## WE USED OUR BEAN

In Designing

THE PARKIN DIAL TYPE RHEOSTAT (Pat. pending) and by mounting the resistance element in a circular groove in the back of a 3" molded Bakelite dial eliminated one part and saved you the cost of a dial. The groove being recessed, allows the dial to clear the panel by the usual distance of  $\frac{1}{8}$ ". An off position is provided and a stop on the dial engages the stationary contact at the extreme positions. The 360 degree rotation insures fine adjustment. A brass bearing insures a true running dial and smooth action.

All figures and graduations are filled with brilliant white enamel. All brass parts nickel plated. Bakelite knob.

Resistance is 5 ohms, carrying capacity 2 amps.

No. 77 Parkin Dial Type Rheostat

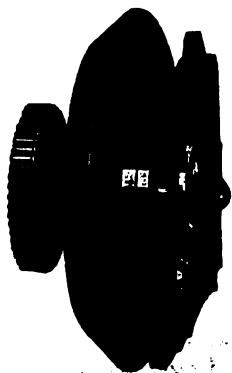
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**PARKIN MFG. CO., San Rafael, Calif.**



ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

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LOWEST

# P.

POWER

# F.

FACTOR

## G.A. Standardized Instrument Panels

**L. P. F.** should be your choice for all instrument panels not only because of its freedom from losses at high frequencies but because of its mechanical advantages.

Bureau of Standards tests show that it has the Lowest Power Factor of any sheet insulation, 0.7% against 3.5% for the best substitute material, and these tests were made at the low wavelengths at which losses are most marked.

In appearance L. P. F. has polished jet black surfaces which take a handsome grain finish and do not turn grey. In dimensions L. P. F. panels are accurate to  $\frac{1}{16}$  in., with true right angle corners, smoothly cut. You can drill, tap, file and cut L. P. F. more easily than other panels. You can throw them across the room but they will not chip or crack. You can subject them to the severest tests and L. P. F. panels will come out on top every single time.

Moreover, in buying L. P. F. you get its electrical and mechanical advantages at a lower price than is charged for inferior substitutes. You can get these panels from your local dealer or directly from the G. A. Company. And remember that every panel carries a yellow label bearing the name "L. P. F." and the G. A. trade mark. A panel which does not bear this label is not L. P. F.

| Length  | Width    | Thickness         | Weight   | Price  |
|---------|----------|-------------------|----------|--------|
| 5 ins.  | 2 ½ ins. | $\frac{1}{8}$ in. | 3 oz.    | \$0.33 |
| 5 ins.  | 5 ins.   | $\frac{1}{8}$ in. | 6 oz.    | .66    |
| 10 ins. | 5 ins.   | $\frac{1}{8}$ in. | 12 oz.   | 1.31   |
| 10 ins. | 10 ins.  | $\frac{1}{8}$ in. | 1 ½ lbs. | 2.62   |
| 15 ins. | 10 ins.  | $\frac{1}{8}$ in. | 2 ½ lbs. | 3.93   |
| 5 ins.  | 7 ½ ins. | $\frac{1}{8}$ in. | ½ lb.    | .99    |
| 10 ins. | 7 ½ ins. | $\frac{1}{8}$ in. | 1 lb.    | 1.97   |
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| 20 ins. | 7 ½ ins. | $\frac{1}{8}$ in. | 2 lbs.   | 3.74   |
| 5 ins.  | 2 ½ ins. | $\frac{1}{4}$ in. | 2 oz.    | .24    |
| 10 ins. | 2 ½ ins. | $\frac{1}{4}$ in. | 4 oz.    | .45    |

If it doesn't bear the yellow label, it isn't L. P. F.

## RADIO and MODEL ENGINEERING

Did you see the article in the December R and M on a rectifying unit for undamped wave telegraph and telephone transmitters, or the one on tuned plate receiver for 150 to 600 meters? Better send for that issue before it's too late. And you want the dope on radio telephone receiving sets in the January number. There were also some handy ideas that will take the kinks out of your shop work too.

When you send in for these back issues put in a dollar extra for a year's subscription to start in with February. R and M gives you the best in strictly practical, construction articles.

BACK COPIES PREVIOUS TO DECEMBER 1921 ARE NOT AVAILABLE

**The General  
Apparatus Co., Inc.**

570-T West 184th Street, New York  
Represented in every city of the United States  
and Canada where radio work is done. Send  
10c. in stamps for the new G. A. catalog.

# RESULTS!!

**DX  
RADIO  
FREQUENCY  
AMPLIFYING  
TRANSFORMERS**



**WILL  
Bring in that  
LONG DISTANCE  
RADIO  
CONCERT**

## ON COIL AERIAL

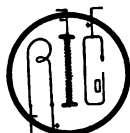
All U. S. Amateur

**RECEIVING RECORDS BROKEN**

with the

**DX-1 Radio Frequency Amplifying Transformers  
Simple Amplifier Construction**

Circuit Diagram Sheet 25c  
Complete data on 4½ ft.  
Coil Aerials 50c



**Send Stamp for  
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*Dealers being supplied*

**RADIO INSTRUMENT COMPANY**

**HUTCHINS BUILDING,**

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*Save You Money*

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| Audiotron Tube Two Filaments                 | \$5.50 |
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| .0005 MF. Grid Condensers                    | .25    |
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| 4 Volt 40 Amp. | \$7.50 |
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| 6 Volt 60 Amp. | 14.00  |
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*We do not charge for crating*

*Above batteries are fully charged when Shipped. The above prices are F. O. B. New York.*

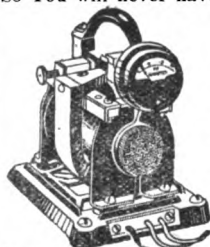
**Hygrade Electrical Novelty Co.**

41 West 125th Street.

New York.

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So You will never have to give up, in disgust when



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Order from your Dealer or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use our Full Wave Automatic F-F Rotary Rectifier of 100 Volt, 36 cell capacity. Order Now or Write for Free BOOSTER Bulletin No. 31 or ROTARY 31A

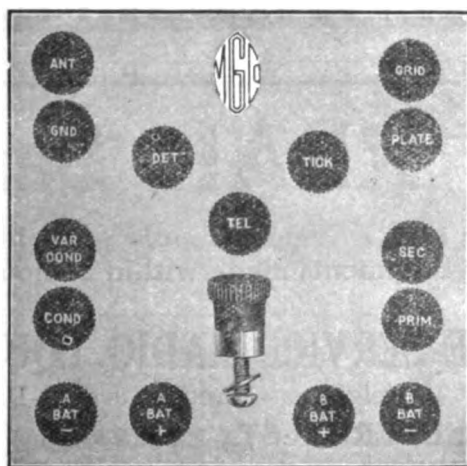
**The France Mfg. Co. CLEVELAND, OHIO, U.S.A.**  
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## New “Read ‘Em” Binding Posts 16 Styles - Engraved - Not Stamped



Complete Post and Knob 15c each

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Ground  
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A—Battery +  
A—Battery—  
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## THE MARSHALL-GERKEN CO.

Manufacturers—Jobbers

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# DEALERS GET SPECIAL PROPOSITION

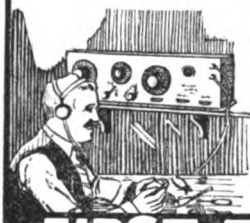
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## KECO-RADIO STORAGE BATTERIES

Are the highest grade batteries built especially for wireless instruments.



Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristal" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, \$20, with book of uses and abuses of the storage battery.

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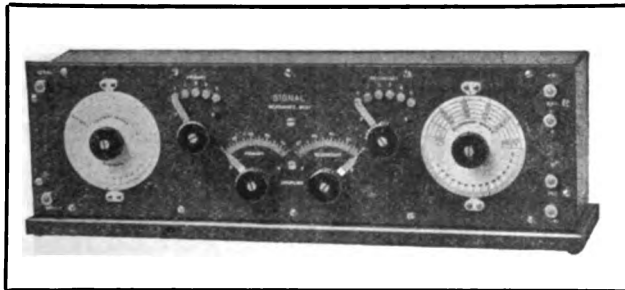


## Do You Take Only "Half Way" Pride in Your Radio Work?

It is impossible for the radio-electrician—professional or amateur—to take real pride in his work with inferior or "half way" instruments.

Whether in the first-grade—or taking a "P. G." in the great School of Radio, you owe it to yourself to be particular to the point of "fussiness" over your equipment.

Consult Radio experts, teachers and students who **know** about



A popular Signal Product—The new short wave Tuner, R-37-C. Described in the new Bulletin.

## "SIGNAL"

Then check up Signal **wireless** apparatus with other makes, price for price, feature for feature. If you do this your choice will invariably be—"SIGNAL". Write us today for literature, names of users and nearest distributor.

**Signal Electric Manufacturing Company**  
**Menominee, Michigan**

**EVERYTHING FOR THE RADIO NOVICE AND PROFESSIONAL**

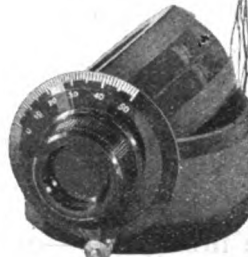
# TUSKA

\$1.10



Type 211

\$7.00



Type 233

\$1.10

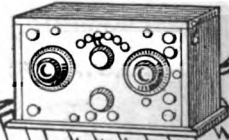


Type 212

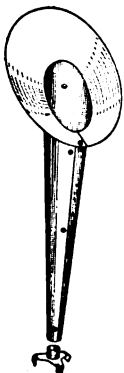
The Tuska Variocoupler is completely moulded. The rotor and primary are wound with green silk wire. Not only is the instrument striking in appearance but highly efficient in design.

Send 5c for Catalog #2

**THE C. D. TUSKA CO.**  
HOADLEY PLACE, HARTFORD, CONN.



## Use this Straight Horn



to eliminate distortion and obtain maximum output from weak signals.

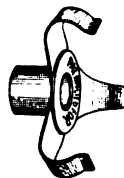
THE STRAMCY HORN has been designed to eliminate as far as possible "horn sounds." It is 20" high and is made of special fibre composition. It is light in weight and stands upright on a telephone when the STRAMCY COUPLER is used. Two horns are better than one on account of variation of tone in different telephones. Buy one for each telephone.

THE STRAMCY COUPLERS enable you to fasten the HORNS to your telephones. They fit over the caps of the telephones and are held firmly in position by three springs. They also fit the tone arm of the Victor or Columbia

phonograph so that you may use the phonograph horn. Made of brass and nickel-plated.

MAILED POSTPAID ON RECEIPT OF PRICE

Price of HORN 75c each  
Price of COUPLER 50c each



**STRAMCY PRODUCTS**

P. O. Box 435, NEWARK, N. J.

## Radio Frequency Transformers

TYPE RT-1 for amateur and broadcasting range

PATENT PENDING

175-500 meters .....\$6.00

Hook up a radio transformer ahead of your detector and get acquainted with stations you have not heard before.



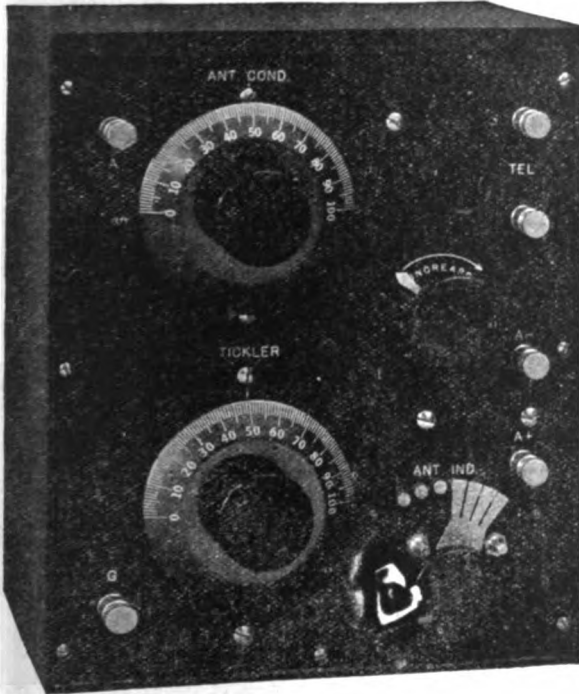
The RT-1 Transformer works on all standard makes of tubes.

**Radio Service Laboratories, Inc.**  
ASBURY PARK, N. J.



# Here's A Receiving Set That Is Guaranteed

—The Clapp-Eastham, Type HR Regenerative Receiver: And the price is only \$35. It's an easy thing to find a set that costs more money, but we'll guarantee that no matter what price you pay, you can't get a set that gives better, more satisfactory results.



Licensed Under Armstrong U. S. Patent No. 1,113,149

If you're looking for the most efficient receiver that can be obtained at any price, ask your dealer to show you the C-E Type—or write us direct.

Send 6c in stamps for a complete Radio Catalog. Each of its three parts describes equally interesting items and it covers every radio essential from the smallest to the largest item.

Tuning is as easy as setting the hands of a watch, and the distance at which signals are received and the sharpness and loudness of tunes is almost beyond belief. Regeneration is perfect on all wave lengths between 180 and 825 meters. Antenna Condenser built as a vernier. "B" Battery may be placed in compartment inside cabinet or external "B" Battery may be used.

The experienced radio man will appreciate the quality indicated by these specifications:

Panel—Formica, handsomely finished.  
Cabinet—Dark Oak, varnish finish.  
Condenser—Balanced type, 2 rotary, 8 stationary plates.  
Dials—Indestructible metal. White figures on black ground.  
Antenna Inductance—Wound on Formica tube.  
Plate Inductance—Wound on moulded ball.  
Binding Posts—Nickel-plated brass.  
Switch—Fan Blade.  
Rheostat—C.E. type H 400.  
Circuit—Single Circuit regenerative.  
Licensed under Armstrong U.S. Patent 1113149.

## CLAPP-EASTHAM COMPANY

RADIO ENGINEERS *and* MANUFACTURERS

114 MAIN STREET,

CAMBRIDGE, MASS.

California Representative: Leo J. Meyberg Co., San Francisco and Los Angeles

127-19

# T & H Radio Company

**Largest Radio Stock In Mid-West**

**Immediate Deliveries**

All items listed are in stock in large quantities.

## CW APPARATUS

|                                    |        |
|------------------------------------|--------|
| UV202 5 watt Radiotron .....       | \$8.00 |
| UV 203 50 watt Radiotron .....     | 30.00  |
| UV216 Kenotron Tubes .....         | 7.50   |
| UV217 Kenotron Tubes .....         | 26.50  |
| UR542 Porcelain Socket .....       | 1.00   |
| UR541 Porcelain Socket .....       | 2.50   |
| PR535 Filament Rheostat .....      | 3.00   |
| PR537 Filament Rheostat .....      | 10.00  |
| UP1719 Grid Leak .....             | 1.10   |
| UP1718 Grid Leak .....             | 1.65   |
| Acme CW Inductance .....           | 8.00   |
| Acme 200 Watt CW transformer ..... | 20.00  |
| Acme 500 Watt Power Trans. ....    | 25.00  |
| Acme Choke Coils, single .....     | 6.00   |
| Acme Choke Coils, double .....     | 8.00   |
| Acme Modulation Transformer ...    | 5.00   |

## RECEIVING APPARATUS

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|----------------------------------|--------|
| UV200 Radiotron, detector .....  | \$5.00 |
| UV201 Radiotron, amplifier ..... | 6.50   |
| Electron Relay, detector .....   | 5.00   |
| A. P. Amplifier tube .....       | 6.50   |
| Grebe CR9 with amplifier .....   | 130.00 |
| Grebe CR8 150-1000 meters .....  | 80.00  |
| Grebe CR5 150-3000 meters .....  | 80.00  |
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| Burgess #2156 "B" Battery ..     | 3.00   |
| Burgess Tapped "B" Battery ...   | 2.75   |
| Baldwin Receivers type C .....   | 12.00  |
| Baldwin Receivers type E .....   | 13.00  |
| Baldwin Receivers type F .....   | 14.00  |
| Brandes "Superior" receivers ... | 8.00   |
| Acme Amplifying transformers ..  | 5.00   |
| Honey Comb Coils, all sizes      |        |

Inquire for monthly stock sheet, shows our complete stock each month. ...CW and radiophone catalog sent any address when four cents in stamps accompanies inquiry.

5th District Distributors for Ideal Apparatus Co.

## T & H Radio Company

**ANTHONY,**

**9ZAC**

**KANSAS**

## 3 NEW LITTLE EBY'S, BOYS

Triplets? GOSH NO!! Because—

2 are BLACK (Insulated) & 1 is WHITE (nickel)

Posts shown are our two latest "BLACK BEAUTIES" ("Junior" & "Junior H") and they sure are Beauts, too. They look just like our "Ensign" post but cost less as knobs are removable.

"BUDDY," our WHITE post, (not shown) is our latest metal post and it's a PIPPIN. It looks like our "Corporal" post but is furnished with a stud and nut; now making it a cinch to mount. Price of "Buddy" complete, nickel finish 15c.

AT LAST! Boys, your long desire to equip your set with EBY posts can now be realized. DEALERS & MANUFACTURERS—Order a stock of these LIVE sellers immediately at our usual attractive discounts.

(Please note price of JUNIOR in Feb. QST should have been 15c each.)

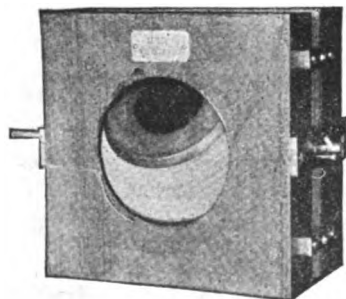


"Junior" 15c  
(including nut  
and washer)



Junior H" 15c  
(including nut  
and washer)

**THE H. H. EBY MFG. CO., 605 ARCH ST., PHILADELPHIA, PA.**



We have in stock panels, switches and other apparatus to complete your set.

## TUNESHARP VARIOMETERS

At the following prices are without doubt the best buy on the radio market today.

### VARIOMETERS

Complete.....\$5.00

Unassembled... 4.00

(P.P. Wt. 8 Lbs.)

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Complete.....\$4.00

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Complete Knocked Down Set Wound \$10.00

(P.P. Wt. 6 Lb.)

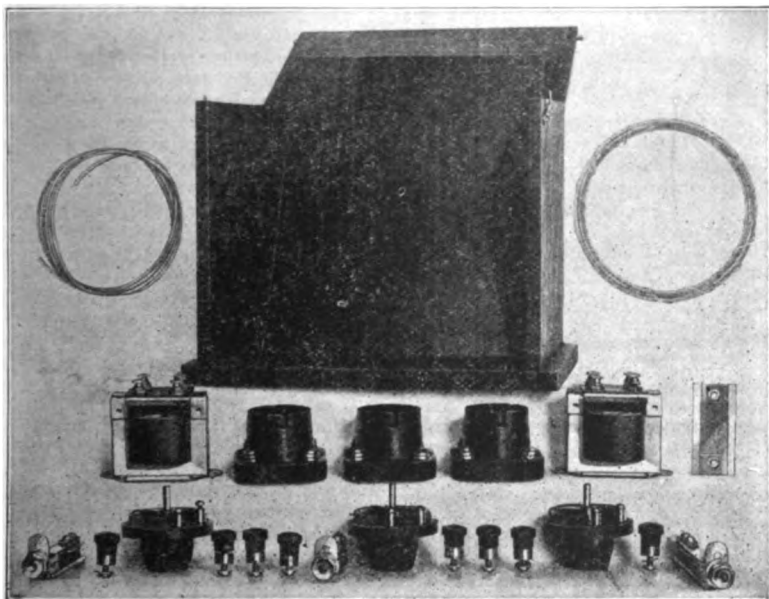
"The House of Service"

**LINZE ELECTRICAL SUPPLY CO.**

**1129 Olive St., Dept. Q3 St. Louis, Mo.**

# "CHI-RAD" APPARATUS

## K-D DETECTOR-AMPLIFIER SET



**PRICE COMPLETE AS SHOWN - - \$25.00**

Add PP on 10 lbs.

Everything to build a high grade detector and two step amplifier at the usual "Chi-Rad" price. Immediate delivery—send in your order today!

### SPECIFICATIONS

Solid oak cabinet, hinged cover to take panel 7"x9".

1 Black Formica panel 7"x9".

2 Thordarson Amplifying Transformers.

1 roll tinned copper wire.

3 Fada Rheostats.

2 Double Federal jacks.

1 Grid Condenser.

3 DeForest Sockets.

1 roll spaghetti tubing.

8 Hard rubber binding posts.

1 Single Federal Jack.

### VACUUM TUBES

Cunningham Detector .....\$5.00

Cunningham Amplifier ..... 6.50

### HEADSETS

Murdock 56, 2000 Ohms ..\$5.00

Murdock 56, 3000 Ohms .. 6.00

Federal 2200 Ohms ..... 8.00

Brandes, Superior type .... 8.00

Brandes, Navy type .....12.00

Baldwin, Type C .....12.00

Baldwin, type E .....13.00

Baldwin, type F .....14.00

### TELEPHONE PLUGS

Western Electric .....\$0.75

Firco, round type ..... 2.50

Firco, flat type ..... 2.00

### B BATTERIES

Burgess, small 22 volts ...\$2.25

Burgess, tapped ..... 2.75

Burgess, large 22 volts ... 3.00

"Chi-Rad" new storage B  
Battery, 2 volt cell, each.. .40

### LOUD SPEAKERS

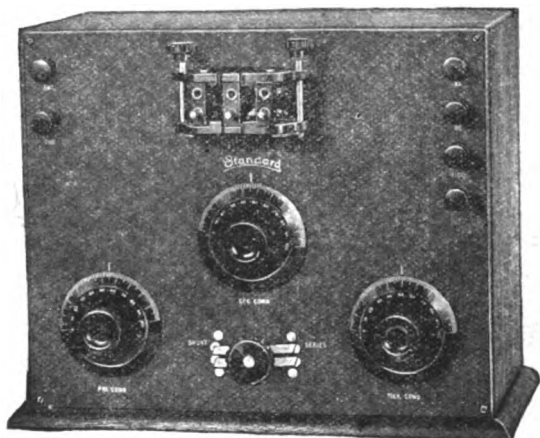
Station type Vocaloud ...\$30.00

Radio Magnavox ..... 45.00

Watch next month for announcement of the new "Chi-Rad" Loud Speaker. A real instrument at the right price. Dealers wire or write for discounts on "Chi-Rad" Apparatus—it is priced reasonably low—yields you a good profit and is in demand by Radio-men everywhere.

**CHICAGO RADIO APPARATUS CO., Inc.**  
508 So. Dearborn St., (Second floor) Chicago, Ill.

# THE STANDARD PLAN—"ASSEMBLED BUT NOT WIRED"



MULTIPLE WAVE TUNER

The Standard plan of distributing high-grade Radio instruments,—fully assembled but not wired,—is ideal for the experimenter who wishes to incorporate his own circuit and at the same time save the wiring cost. The Standard Assembling Co. does all the actual panel drilling and assembling, which is essentially machine work,—and leaves the wiring, which is hard work, for you to do. This offers you an average saving of 20% or more and is the only way in which you can secure correctly machine made instruments without paying for the expensive hand wiring, which you can do just as well. The multiple wave tuner shown here is an example of the Standard plan. It comes to you fully assembled but unwired for \$45.00, a clear saving of at least \$10.00 on what you would ordinarily pay for such a high-grade instrument.

*This tuner will be shipped anywhere in the United States upon receipt of one third the purchase price. Examine the instrument carefully and if acceptable, remit the balance. If you are not perfectly satisfied, simply return the instrument and we will refund your deposit. If you do not wish to order at once, send a stamped return envelope for our literature describing the complete line of Standard instruments.*

**STANDARD ASSEMBLING CO. 91 BRIDGE ST., N. Y. C.**

## IMMEDIATE DELIVERY

Cardboard Tubes, Seamless, Gray,  $\frac{1}{8}$  Wall  $2\frac{1}{2} \times 12$  25c,  $3 \times 12$  30c;  $3\frac{1}{2} \times 12$  35c;  $4 \times 12$  40c;  $4\frac{1}{2} \times 12$  45c;  $5 \times 12$  50c;  $6 \times 12$  60c.

Contact Points—Nickel . . . . . 6 for 30c  
Contact Points—Brass . . . . . 6 for 25c  
Stops—Nickel . . . . . 2 for 10c  
Phone Binding Posts—Nickel . . . . . Each 15c  
Binding Posts, H.R. Top—Nickel . . . . . Each, 10c  
Binding Posts, H.R. Top—Nickel . . . . . Each, 15c

### BRASS BODS, POLISHED and DRILLED

|                                   |                                   |                         |
|-----------------------------------|-----------------------------------|-------------------------|
| $\frac{1}{8} \times 7$ . . . 15c  | $\frac{1}{4} \times 7$ . . . 20c  | SLIDERS                 |
| $\frac{1}{8} \times 9$ . . . 15c  | $\frac{1}{4} \times 9$ . . . 20c  | $\frac{1}{4}$ . . . 25c |
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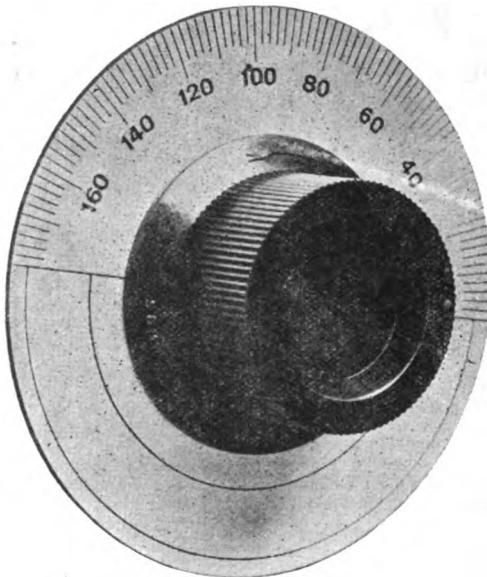
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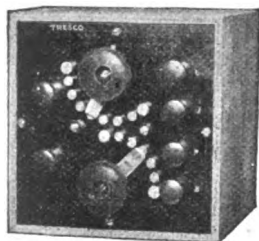
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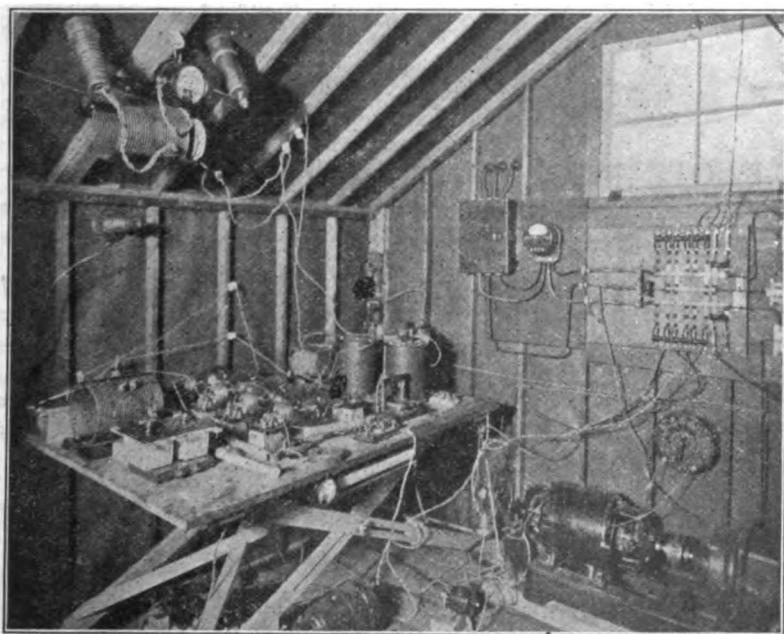
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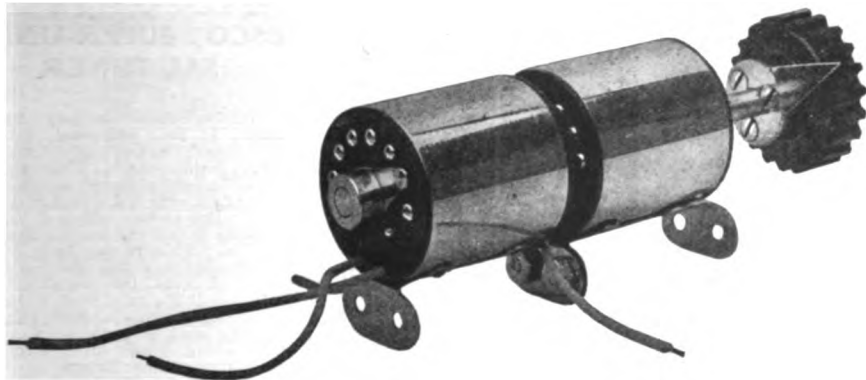
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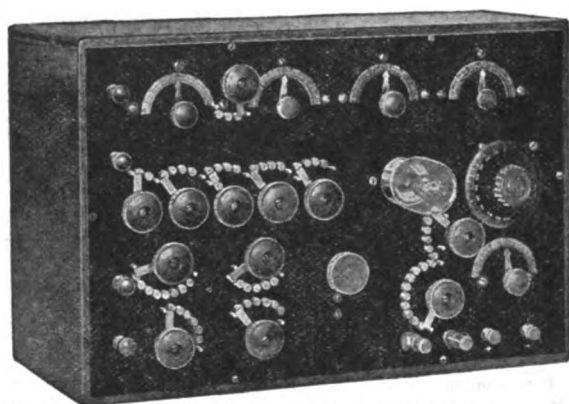
ALTADENA RADIO LABORATORY,

Altadena, Cal.

SCIENTIFIC EXPERIMENTER, LTD.,

Montreal, Canada.

# Listen to the World with



## TRESCO SUPER-UNIVERSAL TUNER

Cabinet 12x17½ inches.

Formica or Hard Rubber Panel.

Weight, 15 lbs.; shipping, 25 lbs.

Wave length range, 150-25,000 M.

Tuners inside—three, AS, BS, KS.

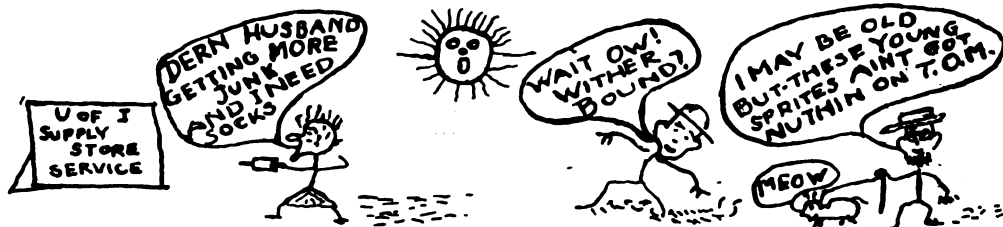
Recommended by users of the Bureau of Markets Reports and guaranteed to get all the wireless signals, ether C.W., spark, or telephone within the range of the sending station. This is the only tuner in the world that has this range of wave lengths and gets the signals on the smallest possible single wire aerial. Arlington time, Annapolis, San Diego signals clearly read through even a violent thunder storm. Nearly all stations in the United States of the Bureau of Markets come in on this tuner in the center of the United States, and no point in the country would prevent the reception of these signals. It is recommended for the Farmer, Bureau of Markets, Schools, Colleges, etc. There is nothing about it to get out of order or need replacing except the high voltage batteries, a replacement of which costs only a few dollars. We ship only by express. We do not ship without testing and calibrating with your bulb, and each one is absolutely guaranteed to do just as we claim or we will refund your money. You do not need to know anything about wireless to operate this tuner or to get the signals and telephone reports. Cabinet is highly polished and all parts nickel finish. If you wish extra loud signals you may use one or two step amplifier, as posts are provided on the tuner for this purpose. We recommend Baldwin or Brown phones. We only sell this tuner assembled and calibrated to your bulb ordered with the set. It is complete with all that is needed except a pair of phones and a few dry cells to light the filament of the Audion. Ready to use when it arrives with full directions so that a child can operate it. Priced at \$100.00, F. O. B. factory.

Licensed Under Armstrong Patent \$1,113,149

TRESCO,

DAVENPORT,

IOWA



Z-NITH  
ACME  
DEFOREST  
BENWOOD  
AMRAD  
TRESCO  
CUNNINGHAM  
KLAUS  
RAY-DI-CO  
BALDWIN  
PACENT  
FEDERAL  
BRANDES

**QUALITY**



**SERVICE**

4 cents brings bulletins.

**THE U. OF I. SUPPLY STORE**

627-29-31 WRIGHT STREET,  
CHAMPAIGN, ILLINOIS

MURDOCK  
BURGESS  
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WESTINGHOUSE  
CHI-RAD

### —FORMICA PANELS—

Marked off, drilled, grained, buffed. Large holes cut for meters. Send drawing with exact dimensions for estimate. We guarantee quick service, accuracy and satisfaction.

**RADIO PANEL SHOP**

1103 S. Third St., Evansville, Ind.

### MANUFACTURERS OF

# CW

## APPARATUS

One to Six Stage Amplifying Receiving Sets  
SEND 10c. FOR CATALOGUE

The American Radio Sales & Service Co.  
MANSFIELD, OHIO



VACUUM TUBE

|                      |                      |                      |
|----------------------|----------------------|----------------------|
| SERIES               | TRANSMIT             | RECEIVE              |
| 3 <sup>RD</sup> STEP | 2 <sup>ND</sup> STEP | 1 <sup>ST</sup> STEP |
| TICKLER              | GRID VARIOMETER      | PLATE VARIOMETER     |
| SECONDARY CONDENSER  | B BATTERY<br>- +     | A BATTERY<br>- +     |
| OUTPUT               | INPUT                | PRIMARY CONDENSER    |
| TELEPHONE            | PARALLEL             | DETECTOR TUBE        |
| + -                  | COUPLING             |                      |

### A COLOSSAL EVENT THE "RASCO" CATALOG

There are many radio catalogs, but the "Rasco" catalog marks a radical change for the simple reason that it

#### Contains 50 Vacuum Tube Hook-Ups

This is the one and only radio catalog containing such wonderful free information. Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector; detector and one-step amplifier; regenerative circuit; DeForest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, Inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2 tube C.W. transmitter; V.T. transmitter with 6 volt battery; radiophone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Colpitts oscillator circuit.

The catalog contains 185 illustrations. On account of its great cost, this catalog cannot be distributed free of Charge. It will only be mailed upon receipt of

15c IN STAMPS OR COIN

WE GUARANTEE EVERY ORDER  
SHIPPED WITHIN 24 HOURS

# Radio Specialty Co.

98-100 PARK PLACE, NEW YORK CITY

Factories:  
Brooklyn, N. Y.—Elkridge, Md.

### "RASCO" BRASS NAME PLATES

Illustrations are in full size. Order by name.

The two top plates, "Increase current," list at 10c each, illustrations full size. All others are 5c each. We also have these, not illustrated: Phones, Loading Coil, Aerial, Ground, Secondary, Primary, Audion, Detector, Off, On, each 5c. In dozen lots, 50c prepaid.

NEW. The white plate in the lower right-hand corner is blank, and made of such material that you can write your own lettering on it with pencil, ink or China ink. Price each 5c.

### "RASCO" AUDIO FREQUENCY TRANSFORMER

This transformer has been developed by us after comparing all the various transformers on the market. This transformer is guaranteed to equal any on the market today. The primary and secondary are very carefully built and are impregnated with a certain wax in vacuum. The stampings are of the best silicon steel. Only the very best material is used throughout.

Realizing the fact that most amateurs desire to "make their own" we furnish this transformer unassembled. Directions which accompany the transformer are such that anyone can put the parts together in about ten to twelve minutes. This saves you considerable money, for the reason that manufacturers who assemble the transformers must charge you for the assembling work.

Illustration as shown is in full size. The weight complete is ten and one-half ounces. Note also that we ship all goods prepaid. We pay the freight.

No. 1100 "Rasco" Audio Frequency Transformer NOT ASSEMBLED, prepaid

**\$2.65**



#### DEALERS

Get Our Special Proposition

Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF

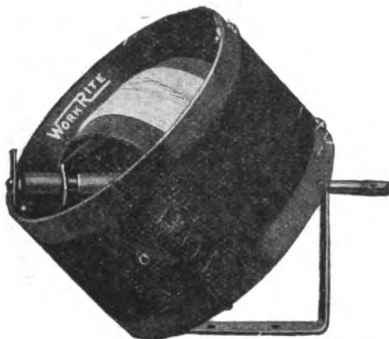
OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. A trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

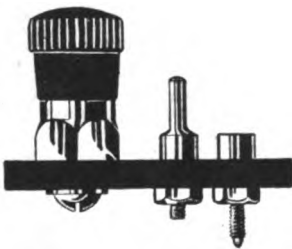
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# "WORKRITE" PRODUCTS WORK RIGHT

**WORKRITE SUPER VARIOCOUPLER:** Rotor and Stator made from formica, wound with double silk covered wire, rotor specially bank wound. Has  $\frac{1}{8}$ " shaft, can be mounted on panel or base. Extremely sensitive and tunes unusually sharp. 200 to 600 meters. Immediate delivery. Price \$3.00.



**TYPE "A" WORKRITE HYDROMETER:** Double the life of your battery by giving it proper care. Never let it get below 1150. Use a "WORKRITE" Hydrometer to fill and test it. Price \$1.00.



Binding Posts, 12c; Switch Stops, 6c; Switch Points, 4c; Complete Switch Arms with bushings, 50c. All metal parts made from brass, nickel plated.

All orders for 50c or more sent by mail prepaid. Satisfaction guaranteed or money back.

**THE WORKRITE MFG. CO.**

5601 Euclid Avenue,  
Cleveland, O.

## QST Pittsburgh Amateurs!

You will find us in a position to supply your needs in radio supplies

Westinghouse, Amrad, DeForest, Acme, Murdock, Federal & Brandes  
Complete Antenna and ground equipment.

—PARTS—

Come in and  
See Us  
**QUALITY**

**DEVON**  
ELECTRIC CO. INC.

Mail Orders  
Promptly Filled  
**SERVICE**

613 LIBERTY AVENUE,

PITTSBURGH, PA.

### Telephone and Musical Concerts

If you want to hear them, get our simple diagram and hook up advertised this issue under classified advertisements.

**VIRGINIA NOVELTY COMPANY**  
Martinsburg, West Va.

### AN ORIGINAL SURPRISE

Our next month's advertisement

**DX RADIO COMPANY**  
Summit, Ill., Factory, Argo



## SERVICE

### AMPLIFIER & DETECTOR PANELS

|  |         |
|--|---------|
| Westinghouse DA, amplifier                                   | \$68.00 |
| Remler, No. 300, detector                                    | 8.00    |
| Remler, No. 331, amplifier, less transformer and cam switch  | 6.00    |
| Remler, No. 333, amplifier, with cam switch less transformer | 9.00    |
| Clapp-Eastham HZ, in cabinet                                 | 38.00   |

### REGENERATIVE RECEIVERS

|   |        |
|---|--------|
| Westinghouse RA, 180-700 meters, very selective, mahogany cabinet                       | 68.00  |
| Westinghouse RC, consisting of units DA and RA combined in one cabinet, wonderful value | 130.00 |
| Clapp-Eastham HR and detector   | 35.00  |
| Clapp-Eastham ZRF, in cabinet   | 38.00  |
| Grube—all types   |        |

### ANTENNA WIRE

|   |      |
|---|------|
| Wece, 7 strands 322 pure copper per ft. | .01  |
| per 500 ft.                             | 4.00 |
| per 1000 ft.                            | 6.50 |

### ANTENNA INSULATORS

|                              |      |
|------------------------------|------|
| Electrose, Ball type         | .40  |
| Electrose, 4 inch Rod type   | .50  |
| Electrose, 10 inch Rod type  | 1.00 |
| WECO "Special" 3 in Rod type | .25  |

### BATTERIES "B"

|   |      |
|---|------|
| WECO No. 1001 22½ V. small, plain       | 1.50 |
| WECO No. 1002, 22½ V. small, variable   | 1.75 |
| WECO No. 1003, 22½ V. large, plain      | 2.50 |
| WECO No. 1004, 22½ V. large, variable   | 3.00 |
| WECO No. 1005, 45V. special, plain      | 5.00 |
| WECO No. 1006, 45V. special, variable   | 6.00 |
| WECO No. 1007, 45V. Super-special, var. | 3.50 |

### BATTERIES "A" STORAGE

|                                       |       |
|---------------------------------------|-------|
| Eveready, Special 6-8V., 80 amp. hour | 12.00 |
|---------------------------------------|-------|

### CONDENSERS (FOR C.W. WORK)

|   |      |
|---|------|
| No. UC-1014 Radio Corp. .002 MF. 3000 Volts                 | 2.00 |
| No. UC-1015 Radio Corp. .0003, .0004, .0005 MFD. 7500 volts | 5.40 |
| No. UC-1803 Radio Corp. .000025 MF. 10,000 volts            | 5.00 |
| No. UC-1806 Radio Corp. .002 MF. 6,000 volts                | 7.00 |

### CONDENSERS (GRID AND PLATE TYPES)

|                                       |      |
|---------------------------------------|------|
| No. UC-570 Radio Corp. .0025 MF.      | 2.00 |
| No. UC-569 Radio Corp. .001 MF.       | 1.50 |
| No. UC-568 Radio Corp. .0005 MF.      | 1.35 |
| No. UC-567 Radio Corp. .00025 MF.     | 1.20 |
| No. UX-543 Radio Corp. Condenser Mtg. | .50  |

### CONDENSERS (FILTER TYPE)

|   |      |
|---|------|
| No. UC-1631 Radio Corp. .5 MF. 750 Volts  | 1.35 |
| No. UC-1632 Radio Corp. 1 MF. 750 Volts   | 1.85 |
| No. UC-1634 Radio Corp. .5 MF. 1750 volts | 1.50 |
| No. UC-1635 Radio Corp. 1 MF. 1750 volts  | 2.00 |

### C.W. INDUCTANCES

|                         |       |
|-------------------------|-------|
| No. UL-1006 Radio Corp. | 11.00 |
| No. P-1 Acme            | 8.00  |

### C.W. POWER TRANSFORMERS

|                                     |       |
|-------------------------------------|-------|
| No. UP-1638 Radio Corp. 325 watts   | 25.00 |
| No. UP-1016 Radio Corp. 750 watts   | 38.50 |
| Acme 200 watt 350-550 volts, Mtd.   | 20.00 |
| Acme 200 watt 350-550 volts, unmtd. | 16.00 |

### FILTER REACTORS

|                              |       |
|------------------------------|-------|
| No. UP-1626 160 Milliamperes | 11.50 |
| No. UP-1627 300 Milliamperes | 15.75 |

### GRID LEAKS (RADIO CORPORATION)

|  |      |
|--|------|
| No. UP-1719 for 5 watt tubes                                     | 1.10 |
| No. UP-1718 for 50 watt tubes                                    | 1.85 |
| No. UP-516 ½, 1, 1.5, 2 or 3 megohms each complete with mounting | 1.25 |
| Grid leaks only, each  | .75  |

### LOUD SPEAKERS

|                                     |        |
|-------------------------------------|--------|
| No. R-3, Radio Magnavox, large horn | 45.00  |
| No. R-2, Radio Magnavox, 22" horn   | 110.00 |
| Vocaloud, station type              | 30.00  |
| Vocaloud, laboratory type           | 25.00  |

### JACKS

|  |      |
|--|------|
| Rhamstine plug and jack, 2-circuit             | 1.50 |
| Federal open circuit, No. 1421-W               | .70  |
| Federal closed circuit, No. 1422-W             | .85  |
| Federal 2-circuit, No. 1423-W                  | 1.00 |
| Federal automatic filament control, No. 1435-W | 1.20 |
| Federal automatic filament control, No. 1438-W | 1.50 |

### PLUGS—TELEPHONE

|                                   |      |
|-----------------------------------|------|
| Facent No. 50, Universal type     | 2.00 |
| Federal No. 1428-W brass          | 2.00 |
| Federal No. 1426-W, silver plated | 2.50 |

## QUALITY

## SATISFACTION

### POTENTIOMETERS

|   |      |
|---|------|
| Clapp-Eastham F-743, 5000 ohm "B" battery type  | 3.00 |
| Radio Corporation No. PR-356, "A" Battery type  | 2.00 |
| Remler No. 93, panel mounting, "A" battery type | .75  |

### RHEOSTATS

|   |      |
|---|------|
| Clapp-Eastham H-400, twin                                   | 1.35 |
| Murdock No. 560, panel mounting, new type                   | 1.00 |
| Paragon No. F-2, front and back mounting                    | 1.50 |
| Radio Corporation No. PR-535 for UV-200, 201, 202 tubes     | 3.00 |
| Remler No. 810 Junior panel mounting                        | 1.00 |
| Remler No. 811, 1.5 amp. type panel mounting                | 1.75 |
| Remler No. 813, 3 amp. type panel mounting for 5-watt tubes | 1.75 |
| Remler No. 810, renewal units                               | .20  |
| Remler No. 811 or No. 813 renewal units                     | .25  |
| "Shramco" No. 90-P, 6 amps. for one 50-watt tube            | 2.00 |
| Kleesner, Vernier, simple, positive                         | 1.50 |

### SOCKETS

|   |      |
|---|------|
| DeForest No. R-300, front and back connected                                    | 1.50 |
| General Radio No. 156   | 1.50 |
| Radio Corporation No. UR-542, porcelain, for 200, 201, 202 and 216 tubes        | 1.00 |
| Radio Corporation No. UT-541, porcelain, for UV-203 and 217 tubes               | 2.50 |
| Radio Corporation No. UT-552, bakelite type, for UV-200, 201, 202 and 216 tubes | 1.50 |
| Radio Corporation mountings, 250-watt tubes UT-501 and UT-502                   | 4.50 |
| Remler No. 92, molded bakelite (very good)                                      | 1.50 |
| Murdock No. 550, molded   | 1.00 |
| Paragon   | 1.00 |
| Crosley   | .80  |

### TELEPHONES

|   |       |
|---|-------|
| Baldwin type C, latest price                  | 12.00 |
| Baldwin type E, latest price                  | 13.00 |
| Baldwin type F, latest price                  | 14.00 |
| Baldwin type G, latest price                  | 15.00 |
| Baldwin loud speaker unit                     | 6.00  |
| Baldwin head band                             | .75   |
| Conn. Tel. and Electric, 2000 ohms            | 6.00  |
| Conn. Tel. and Electric, 3000 ohms            | 6.50  |
| Murdock No. 55, 2000 ohms                     | 4.50  |
| Murdock No. 56, new type head band, 2000 ohms | 5.00  |
| Murdock No. 56, new type head band, 3000 ohms | 6.00  |

### VACUUM TUBES

|                                  |        |
|----------------------------------|--------|
| No. UV-200 Radiotron detector    | 5.00   |
| No. UV-201 Radiotron amplifier   | 6.50   |
| No. UV-202 Radiotron 5 watt      | 8.00   |
| No. UV-203 Radiotron 50 watt     | 30.00  |
| No. UV-204 Radiotron 250 watt    | 110.00 |
| Moorhead Electron Relay Detector | 5.00   |
| Moorhead Amplifier               | 6.50   |
| Moorhead Transmitter             | 7.00   |

### BATTERY RECTIFIERS

|                                |       |
|--------------------------------|-------|
| Westinghouse, 2 amp. with bulb | 18.00 |
| Westinghouse, 5 amp. with bulb | 28.00 |
| F. F. Bantam Booster 5 amp.    | 15.00 |

### GIVE US A TRIAL!

SEND US YOUR ORDERS—WECO SERVICE EXTENDS WHEREVER THE RADIO WAVE CARRIES.

We Have Five Branch Stores—Postage Prepaid  
Send six Cents for Our Bulletin No. 25



YOU WILL LIKE TRADING WITH US

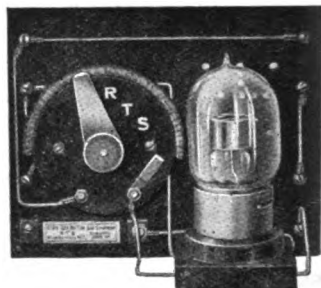
# THE WONDERFULLY PERFECTED RTS Standard Detector Panel

## Ten Points of Superiority



(Front)

- 1—Silver Plated Wire
- 2—Machine Engraved Scale
- 3—Resistance, 8 Ohms
- 4—Small Wound Resistance
- 5—Grid Condenser and Leak accurate
- 6—Sure Contact Socket
- 7—Socket Used as a Standard
- 8—Decreased Resistance in Leads
- 9—Machined Letter Engraving
- 10—All Posts and Parts Perfectly Set



(Back)

**\$5.95**

Without Tube Prepaid by Insured Parcel Post. Install this efficient R.T.S. Panel and you possess a correctly designed Detector Panel capable of producing signal strength unequalled by any other tested in our laboratory. It is guaranteed.

**RTS**

R.T.S.  
Switch  
Lever

**60c**



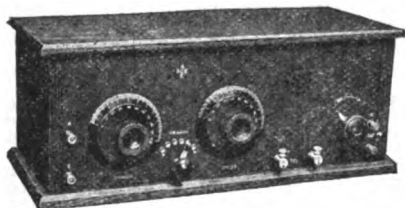
Write today for our new catalog just published.

**Radio Testing Station**

Dept. 3, 25 Sturges St., Binghamton, New York

Knob—Marconi 1 1/4"  
Lever—Special alloy  
Bushing—Fits all panels from 1/8" to 1/4" in thickness.  
Guide Bushing—Nickel plated

## ACE "ACE RADIO CONCERT RECEPTOR" ACE



### Type TRU Concert Receptor \$50.00

This unit is especially designed for the efficient reception of Radio Telephone Concerts from even the most distant Broadcasting Stations. The ease with which this Receptor can be installed and the extreme simplicity of operation make it ideal for use by even the most in-experienced. No previous knowledge of radio necessary to secure results.

We stock a complete line of Radio Supplies and maintain a *prompt, reliable* Mail Order Service that reaches all over the world.

Send 5c in stamps for catalog to Dept. "D".

### The Precision Equipment Co., Inc.

Manufacturers & Distributors of Radio Apparatus  
Peebles Corner, Cincinnati, Ohio

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Cincinnati

Radio  
WMH  
SXB

## NOISELESS DEPENDABLE GUARANTEED



### "B" Batteries for Vacuum Tubes 22 1/2 to 100 Volts

19 Different Sizes—Plain and Variable

**NOVO MANUFACTURING CO.**

424 W. 33d St. 531 So. Dearborn St.  
NEW YORK CHICAGO

### EVEREADY B BATTERIES

Large, list, 3.00 ..... \$2.50  
Small, list, 2.25 ..... \$1.90

### VACUUM TUBES

Detector, list, 5.00 ..... \$4.50  
Amplifier, list, 6.50 ..... 6.00

POSTAGE PAID

**RADIO SERVICE COMPANY**

87 Union Ave.,

Irvington, N. J.

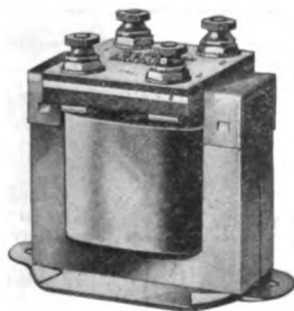
# **THE THORDARSON AUDIO FREQUENCY AMPLIFYING Transformer**

**is now standard with many well known manufacturers**

---

**That should be sufficient guarantee that it is right.**

**SHELL  
TYPE**



**PRICE  
\$4.50**

**Each transformer supplied fully mounted in an ingenious, nickeled frame with substantial terminals mounted on a bakelite terminal board.**

**The terminal board is on the top, the only logical place for a terminal board. The transformer is wound with silk covered wire.**

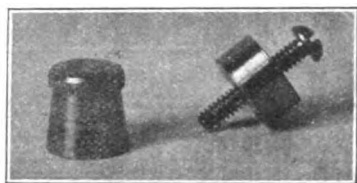
**BACKED BY THE "GOLD MEDAL" LINE.**

**PRICE, AS ILLUSTRATED - - \$4.50**

## **Thordarson Electric Mfg. Co.**

**517 S. Jefferson Street.**

**Chicago**



## We are the Designers, Originators, Manufacturers and Distributors of The Bell Buoy Binding Post (Removable Head)

**The Binding Post for Land and Sea.**

The Peer of all Removable Head Binding Posts. Has the Vise-Grip. Wire will not turn. We leave the Question of its Superiority to You

**15c each—6 for 75c—12 for \$1.45 p.p. prepaid.**

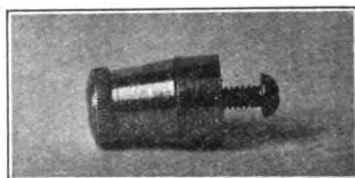
INCLUDES NUT AND LUG

Amateurs Send for Circular.  
Dealers Send for Our Proposition.

### Star Cabinet & Radio Shop

G. W. Calvert, Mgr., Dept. 2  
LANSDALE, MONTGOMERY CO., PA.

(Binding Post Specialists & Experimenters)



*SPECIAL: Fada Non-Removable Head Binding-Posts, 15c each.*

### The Famous Vocaloud

"Bull-dog Grip" Interchangeable Telephone Plugs; Firco-Clad Transformers; Vocatone apparatus; Sterling Silver Contact Jacks; and other Firco products are for sale by all leading dealers.

#### Patent Rights Purchased

The famous Seibt Condensers, Capacity Meters, Frequency Meters, and other Precision Instruments, are now controlled absolutely by this company. We will continue to be the exclusive distributors.

#### A Word To Our Dealers

We are overburdened with orders, but with increased production we are doing our best to keep up with the insistent demand. We ask you to be a little patient on Vocaloud deliveries. Station type now \$35; Laboratory type \$30.

*Place your orders now for April and May requirements so you will be in line for prompt delivery.*

**JOHN FIRTH & CO., Inc.**

18 BROADWAY

NEW YORK

### Best of Everything in Radio Apparatus and Parts

Send Stamp for Catalog "Q"

**J. H. BUNNELL & CO.**

32 Park Place,

New York

## Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

#### SPECIAL!

|                                 |        |
|---------------------------------|--------|
| Vacuum Tube Sockets.....        | \$1.25 |
| Rheostats .....                 | 1.25   |
| 22½ Volt "B" Batteries.....     | 1.50   |
| Rasco Dials .....               | .60    |
| Rubber Binding Posts.....       | .20    |
| Tested Galena.....              | .40    |
| Lateral Wound Coils. All Sizes. |        |

Send 5c for our large illustrated catalog.

**J. M. PAQUIN,**

THE ELECTRICAL SHOP,

787 Queen St. West, Toronto, Ont.

### SHREVEPORT

THE HEART OF THE FIFTH DISTRICT  
We stock leading makes of—

#### RADIO APPARATUS

MAIL ORDERS A SPECIALTY

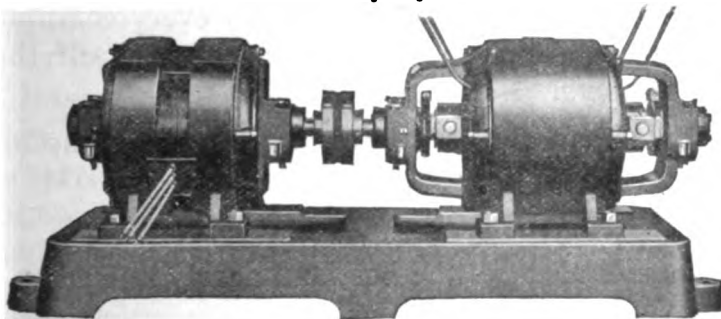
**Shreveport Radio Supply Co.**

P. O. Box 600, 222 Texas St., Shreveport, La.

# 1BCG-GREENWICH- FIRST KNOWN STATION TO GET ACROSS

**MR. CRONKHITE PUT IT OVER WITH THIS SET**

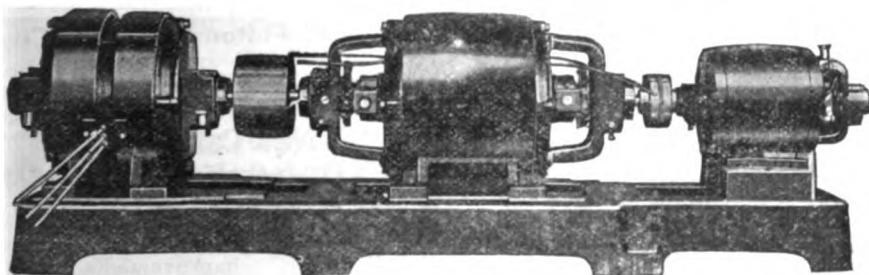
Read remarkable power of this outfit on Page 25—January "Wireless Age" and Page 29 February "QST".



**2 Unit—4 Bearing—1500 Watt**

**2FD—FLUSHING Got Across With Similar Set**  
**1RU—HARTFORD Also—But With a 250 Watt Set**

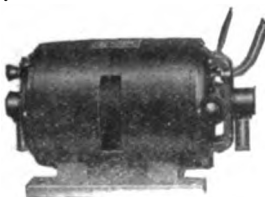
**1BKA—GLENBROOK Put it Over With This**



**3 Unit—500 Watt Outfit**

**9HK—CLINTON, Iowa, Goes Coast to Coast With This Little Set**

**2 BEARING**



**100 WATT**

THESE (AND OTHER) INSTITUTIONS USE OUR MOTOR-GENERATORS  
MASS. INSTITUTE OF TECHNOLOGY  
QUEENS UNIVERSITY, CANADA  
COLLEGE ST. CROIX, CANADA  
LAFAYETTE COLLEGE, EASTON  
UNIVERSITY OF MISSOURI  
UNIVERSITY OF IOWA  
BILLINGS POLYTECHNIC, MONTANA  
PHILA. SCHOOL OF W. T.  
NORTHWESTERN SCHOOL OF W. T.

USE OUR MOTOR-GENERATORS  
PRINCETON UNIVERSITY  
CLARK UNIVERSITY, WORCESTER  
FORDHAM UNIVERSITY  
UNIVERSITY OF SO. DAKOTA  
RICE INSTITUTE, TEXAS  
UNIVERSITY OF FLORIDA  
DENVER SCHOOL OF MINES  
HAMMOND RADIO RESEARCH LAB.  
ASBURY PARK RADIO SCHOOL

WRITE FOR BULLETIN 237

## ELECTRIC SPECIALTY CO.

MOTORS—DYNAMOTORS—GENERATORS—MOTOR GENERATORS

DEPT. Q

Trade **"ESCO"** Mark

**STAMFORD, CONN., U. S. A.**

PIONEERS IN DEVELOPING HIGH VOLTAGE D.C. GENERATORS

# ANNOUNCEMENT

**NEW BRANCH** consists of **SALES ROOM, CLUB ROOM,** and **RADIO INFORMATION BUREAU** with every complete set at your disposal for testing out and judging for yourself the proper set you wish to buy.

Every advantage is given the buyer to get in on the line of  
**RADIO APPARATUS.**

**FLOOR SPACE 3500 SQUARE FEET**

**Full Stock on Hand** of all the best and nearly all makes of wireless apparatus and parts.

**MEET US AT THE RADIO CONVENTION MARCH 7th**

*Send 15c. for new catalog Q-3*

**American Electro Technical Appliance Company**

**New Branch 227 Fulton St., Old Bldg., 235 Fulton St., N. Y. City**

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Whether you are interested in a complete radio receiving outfit, or a half a dozen binding posts, you'll find the particular instrument, best for your needs, in Corwin's catalogue. Send 10 cents, (credited to your first order) for your copy today! Where's the nearest mailbox?

**A.H. CORWIN & CO.**  
4 West Park St. Dept. D  
Newark New Jersey



**New Catalog E6 FREE**  
Just off the press

**24-Hour Service**

**We pay all Shipping Charges**

**Get the latest**

**Don't buy till you see this catalog.**

Keep up-to-date. Learn about all the big recent improvements in radio apparatus.

84 pages chuck full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything.

**Two N-S LEADERS**

Red-Head Radio phones, 3000 ohms, military head band with cord complete Per pair **\$8.00**  
Arlington Tested Cry-stals; Galena or Silicon. Certified super-sensitive Per crystal **25c.**

*Write for Big Free Catalog Today*

**THE NEWMAN - STERN CO.**  
Newman--Stern Bldg., Cleveland, Ohio

The next time you need radio supplies, write us

**THE HOUSE OF QUALITY, SERVICE, PRICE**

**KELLY & PHILLIPS**  
312 FLATBUSH AVE., BROOKLYN, N. Y.

**YOU NEED A "RADINDEX" !!**

With a "RADINDEX" (Radio Index) Card Filing System you have, at your finger-tips, complete data on all stations—dates you heard or worked them, etc. etc. Write for circular and sample card.

**GEORGE H. BARNES**  
Stanbridge East, Quebec, Canada.

## WANTED FOR MURDER!

Poorly designed phones "murder" weak signals. Oftentimes they cut receiving efficiency in half, and yet how many amateurs realize their importance? A costly receiving equipment may detect and amplify a weak signal, but whether or not that signal will be heard depends upon the 'phones used. They may make the most of the signal or they may "murder" it. If your 'phones are 50% efficient, how can your receiving set be 100% efficient?

Go to your dealer today and get a pair of Brandes on the ten-day-trial money-back-guarantee basis.

Our booklet F will be mailed for 5 cents

It will add to your 'phone education

**C. Brandes, Inc.**

**ROOM 721, 237 LAFAYETTE ST., NEW YORK CITY**

*Member Radio Section Associated Manufacturers of Electrical Supplies.*

# BRANDES Matched-Tone HEADSETS

**NEW MOTORS** FOR ALL PURPOSES  
STANDARD MANUFACTURERS  
PROMPT DELIVERY

**ALL SIZES UP TO 5 H.P.**

**We Specialize in Small Motors & Generators**

ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES  
Largest exclusive Mail Order Small Motor dealers in the world.

CHAS. H. JOHNSTON, Box 119, West End, Pittsburgh, Pa.

**WIRELESS, TELEPHONE GENERATORS**  
500 VOLT - 100 WATT - 3400 R.P.M.  
FOR MOUNTING MOTOR GENERATOR SETS.

**\$28.50 EACH**

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## MARCH SPECIAL

Ace "B" Battery.....\$1.50  
Porcelain VT Socket......50

Total List.....\$2.00

**Both for \$1.35**

Postage Extra

**A.K. Laing Radio Co.**

HANOVER,

N. H.

# ANNOUNCEMENT

**NEW BRANCH** consists of **SALES ROOM, CLUB ROOM,** and **RADIO INFORMATION BUREAU** with every complete set at your disposal for testing out and judging for yourself the proper set you wish to buy.

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*Write for Big Free Catalog Today*

**THE NEWMAN - STERN CO.**  
Newman--Stern Bldg., Cleveland, Ohio

The next time you need radio supplies,  
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**THE HOUSE OF  
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312 FLATBUSH AVE., BROOKLYN, N. Y.

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*Member Radio Section Associated Manufacturers of Electrical Supplies.*

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ALL SIZES UP TO 5 H.P.

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500 VOLT - 100 WATT - 3400 R.P.M.  
FOR MOUNTING MOTOR GENERATOR SETS.

**\$28.50** EACH

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## MARCH SPECIAL

Ace "B" Battery.....\$1.50  
Porcelain VT Socket......50

Total List.....\$2.00

**Both for \$1.35**

Postage Extra

**A.K. Laing Radio Co.**

HANOVER,

N. H.

# HOMCHARGE YOUR BATTERY for A Nickle

A perfect rectifier at last,  
fully automatic and fool-  
proof in every respect.  
It can be operated by  
anyone.



## The HOMCHARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is selfpolarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replaceable as a unit for \$1.00. The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than \$100.00. Bulletin 628 proves it. Ask for your copy.

Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. Cannot injure battery—will last a lifetime—approved by underwriters—satisfaction guaranteed. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price—\$18.50. (\$20 West of the Rockies.)

### ATTENTION MOTORISTS:

Send for special bulletin 58 showing how easy it is to "HOMCHARGE" your battery.

THE AUTOMATIC ELECTRICAL DEVICES CO.

127 West Third St., Cincinnati, Ohio

Canadian Distributors  
**POWLEY & MOODY**  
Ltd., Toronto



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## RADIO CITIZENS

Complete stocks carried  
for immediate shipment of  
the following apparatus:

Grebe Murdock  
DeForest Adams-Morgan  
Acme Radio Corporation  
C. Brandes, Inc.  
Federal Telephone & Tele-  
graph Co.

### FREE BULLETINS PRICE LISTS

Get the new lowest prices  
on apparatus and supplies.  
Bulletins and price lists mail-  
ed FREE on your request.  
Send for them today.

**Nash Electrical Service Co.**  
Marshall, Ill.

## CARDBOARD TUBING

IN ANY LENGTH UP TO 28 INCHES

|  | Per in. or<br>Fraction | Per<br>Ft. |
|--|------------------------|------------|
| 2½, 3 and 3½ in. diameter ....             | 3½c                    | 30c        |
| 4 and 4½ in. diameter .....                | 4c                     | 36c        |
| 5 in. diameter .....                       | 4½c                    | 42c        |
| 5½ and 6 in. diameter .....                | 5c                     | 50c        |
| 2½, 3, 3½, 4 in. diameter have ¼ in. wall: |                        |            |
| 4½, 5 and 6 in. diameter have ⅜ in. wall   |                        |            |

Postage extra; shipping weight 1 lb. per ft.

NO stamps accepted on orders.

## MICHIGAN RADIO CO.

(Formerly Jeffery Crawford Co.)

2173 HILLGER AVE., DETROIT, MICH.

## "SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps today  
for our new Catalogue L showing com-  
plete line of parts, raw materials and  
high grade apparatus.

Dealers: Write for our attractive  
proposition.

**The Shotton Radio Mfg. Co.,**  
INCORPORATED  
8 Market St., Albany, N. Y.

## Latest and Best Books on Wireless Chemistry Invention Automobiles Aviation

SEND FOR FREE CATALOGUE W.

**D. ALTMAN COMPANY**  
225 East 110th St., New York



## ANNOUNCEMENT!

A New Arrival In the DeForest Family

### The Moulded, Inherent Balance Condenser

Movable and Stationary Plates are divided into two groups, the two sets of movable plates being moulded onto the shaft on opposite sides. Stationary Plates are moulded to six supporting columns.

This new model is made in three capacities, both mounted (as illustrated) and unmounted. Prices unmounted include knob and dial.

|                  |                  |        |
|------------------|------------------|--------|
| CV-101, capacity | .0005, mounted   | \$5.00 |
| CV-100, capacity | .0005, unmounted | 4.75   |
| CV-201, capacity | .001, mounted    | 5.50   |
| CV-200, capacity | .001 un-         |        |
| mounted          |                  | 5.25   |
| CV-301, capacity | .0015, un-       |        |
| mounted          |                  | 6.00   |
| CV-300, capacity | .0015, un-       |        |
| mounted          |                  | 5.75   |

**DeForest Radio  
Telephone &  
Telegraph Co.  
New York  
City**



Are You **HEARING** by Radio  
Music and News Each Night?

Begin today

Buy the Best

**GREBE**  
CR8

**GREBE**  
CR9

*Now in stock, immediate shipment*

**The Best in Radio Apparatus**

*Wholesale*

**3XAB**

*Retail*

**VIRGINIA RADIO CO., Charlottesville, Va.**

PROMPT SHIPMENTS FROM

**“DEL FELCO”**

**DELANCEY FELCH & CO.**  
**12 Meeting St., Pawtucket, R. I.**

Branches:

**Fall River, Mass.**  
**84 No. Main St.**

**Providence, R. I.**  
**6 Market Square**

# RADIO MAGNAVOX

The  
reproducer  
with the  
movable coil



Type R3  
\$45.00  
Type R2  
\$110.00

No set complete without one

## There is NO Substitute for the Radio MAGNAVOX

Properly energized, the Radio MAGNAVOX will accomplish what no other Radio reproducing apparatus ever has accomplished—*great sound intensity without distortion.* It's the famous *movable coil* that does it, and no other apparatus has this coil because it is *patented* by The Magnavox Co. That is why *there is no substitute for the Radio MAGNAVOX*, and no set is complete without one. It provides a source of satisfaction and scope of enjoyment obtainable from absolutely no other equipment or in no other way. Sold by dealers. Write Dept. "S" for free folder.

Dealers  
write for  
proposition



REG. U.S.  
PAT. OFF.

THE MAGNAVOX CO.



GENERAL OFFICES & FACTORY  
OAKLAND, CALIFORNIA

NEW YORK OFFICES  
370 SEVENTH AVE. PENN. TERMINAL BLDG.

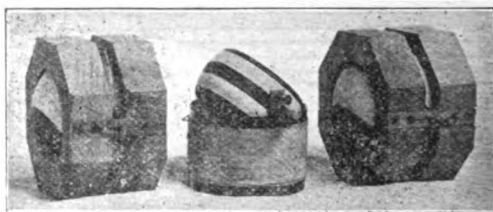


Plate  
Variometer \$3.60

Grid  
Variometer \$3.60

Vario-  
Coupler \$3.00

**SPECIFICATIONS:** Designed for Panel mounting.  $\frac{1}{4}$ " Brass shafting used throughout. Wave length range 175-450 meters. Range may be increased to 650 by shunting secondary with special condenser.

**KNOCKED DOWN SET** of parts, as shown above with windings in place, for 8.75, two variometers and one vario-coupler.

Single variometer parts as described, consisting of two stators and a rotor, made of gum or poplar wood, well shellaced, complete with set of bearings and parts, but **UNWOUND**. Price .....\$1.45  
Winding Form. Price each .....\$0.30

Vario-Coupler parts, consisting of a formica tube, rotor and the necessary bearings and parts for complete assembling. Ready for winding and assembling.

Price .....\$1.45  
Price of Stator, only .....\$0.40



**HI-GEE "B" Batteries ARE SUPREME** because they are lowest in price, have a longer life, marvelous recuperation, and unequalled shelf depreciation.

HI-GEE batteries are made in two grades: Grade 101, size  $2\frac{1}{2} \times 2 \times 3\frac{3}{4}$ , 22½ volts, \$0.90  
Grade 101, tapped 1.10  
**HI-GEE STORAGE BATTERIES:** These are the best batteries on the market for lighting the filaments of your tube sets. They are backed by a **TWO YEAR GUARANTEE.**

6 volt, 60 ampere .....\$12.95  
6 volt, 80 to 100 ampere, ..... 20.95

All storage batteries are shipped **FULLY CHARGED**, ready for use. Add \$0.50 for special crating. **THIS STORAGE BATTERY IS THE BEST THAT MONEY CAN BUY—IT IS MADE UP FOR US BY ONE OF THE OLDEST BATTERY MANUFACTURERS IN THE COUNTRY. THAT'S WHY THIS BATTERY CARRIES A BETTER GUARANTEE THAN ANY OTHER BATTERY YOU WILL BUY AT A HIGHER PRICE. NO SECONDS—EVERY PART USED IS ABSOLUTELY NEW.**

**HI-GEE UNASSEMBLED RECEIVER**, Catalogue Nr. 608. This receiver consists of stained oak cabinet, 18"x7"x7", hinged top. 1 Formica panel 18"x7"x½" to fit cabinet. 2 HI-GEE Variometers. 1 Winding form for stator coils. 1 Formica Coupler primary tube  $3\frac{3}{4} \times 2\frac{1}{2}$  high. 1 Coupler secondary ball, 7 contact points, 6 binding posts, 1 switch lever, 2 stops .....Price, \$13.90

**HI-GEE Unassembled Receiver**, with all windings in place .....\$17.90  
Cabinet only. Complete with panel ..... 4.85  
Unassembled Receiver same as above, with detector and 1-step amplifier in larger cabinet. Includes all windings .....\$25.00

Get our Bulletins. **"UNEXCELLED SERVICE"**  
Every Order shipped Prepaid—Except storage batteries

**HI-GEE RADIO MFG. CO.**

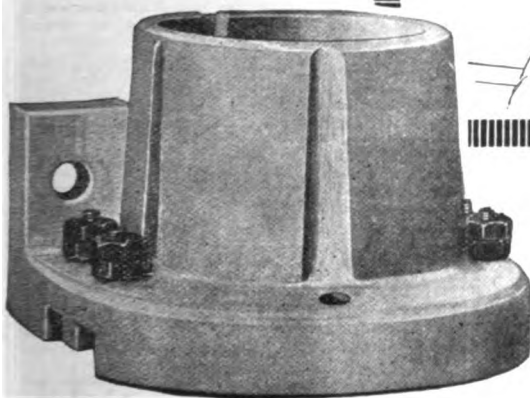
MARION,

ILLINOIS

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# CROSLEY

## V-T SOCKET



PRICE

# 60¢

*Better—  
Costs Less*

Now the CROSLEY V-T Socket has been adopted by several of the leading manufacturers of radio apparatus, as standard in their products. There are many good reasons for this universal acceptance. Here are some of them.

The CROSLEY V-T Socket is made in one piece, of porcelain—the very same material that is used in the base of vacuum tubes—consequently it is of high dielectric value. The bayonet catch is imbedded in a heavy wall of porcelain, that is for all purposes, unbreakable. Soldering irons will not melt this socket and it is ideal for power tube work.

The design positively eliminates all possibility of short circuiting filament across high voltage B Battery.

Almost every leading jobber and dealer in radio equipment, the whole country over, is handling the CROSLEY V-T Socket—NOW. The demand is heavy and its popularity is sweeping the country.

The low price needs no apologies—large production alone makes it possible.

Everyone now says the CROSLEY V-T Socket is "Better—Costs Less."

Buy from your Dealer. He has it or can get it for you.

*To the few Jobbers and Dealers who are not handling the CROSLEY V-T SOCKET, we make the suggestion to get in line.*

**CROSLEY MANUFACTURING COMPANY**  
Radio Dept. Q-8, Cincinnati, Ohio

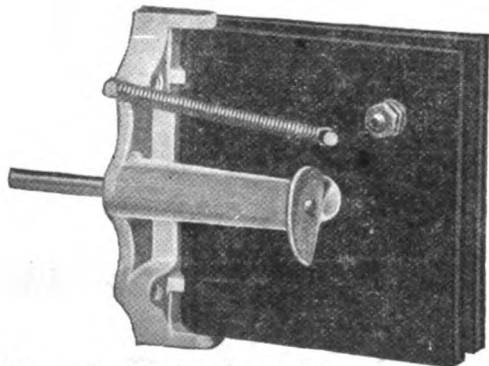
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127

# Crosley Variable Condensers

"Better—Cost Less"

Variable Condensers that do the work—that's the only kind we make. The Auto Electric Service, of Rockport, Maine writes:—"Our station has your Condensers in use and we get KDKA with a Two Step Amplifier loud enough to hear in the next room with the phones on the table. This we could not do with any other make of Condenser." It's the same story everywhere they are used.



## MODEL "B"

Like all CROSLEY VARIABLE CONDENSERS the Model "B" has no appreciable body or hand capacity and is easier to tune in C.W. and I.C.W. than any other condenser made. Conservatively rated capacity, .0005 Mf., but tests in the Laboratories of one of the leading universities of the country have shown the maximum capacity of this model to never be less than .0008 Mf. and frequently running better than .001 Mf. The Model "B" CROSLEY Variable Condenser has best quality laminated wood plates and a die cast metal frame. Extremely neat in appearance. Furnished, ready to mount on panel or in a cabinet, with  $\frac{1}{4}$  in. shaft as standard and  $\frac{3}{8}$  in. shaft optional. This model occupies a space on the panel of  $1\frac{1}{2}$ " x  $3\frac{3}{4}$ " and  $3\frac{1}{2}$ " deep.

Price, each without knob and dial .....\$1.75  
Same, with knob and dial ..... 2.25  
Same, with knob and dial and mounted in mahogany finished cabinet complete with binding posts 3.00

## CROSLEY MODEL "A" Variable Condenser

This instrument needs no further introduction to radio men. Thousands have been sold and are now in use. The conservatively rated capacity is .0005 Mf. and like the other CROSLEY models, it is a universal condenser for C.W. and other transmission work as well as receiving. Every CROSLEY Variable Condenser is tested to withstand 1000 volts before shipment. Just try this test on most air condensers providing you have no further use for the instrument.

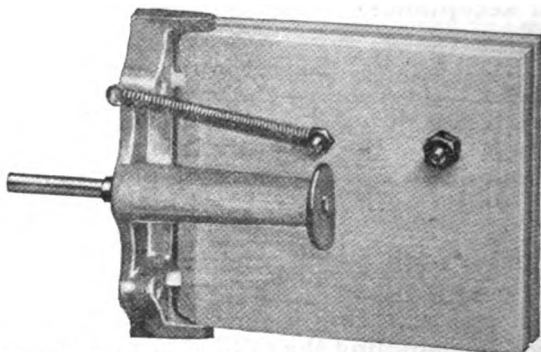
The frame of this model is made of wood; the plates are high grade laminated wood which function perfectly under all conditions.

Price each, without knob and dial .....\$1.25  
Same, with knob and dial ..... 1.75  
Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts ..... 2.50

## CROSLEY MODEL "C" Variable Condenser

The principle of this instrument needs no introduction or explanation—it is made right and it works. This model differs from the other CROSLEY models in the size of the plates, the material of which they are made and the capacity. The plates are made of porcelain, ground true on the contact surfaces before the copper and mica are applied. The capacity is conservatively rated at .001 Mf. and the extremely low capacity makes it ideal for use where a condenser is specified up to .001 Mf. capacity. It is especially recommended for radio phone work as it will not shower or break down, tested under a thousand volts.

Furnished ready to mount on panel or in a cabinet, with  $\frac{1}{4}$  in. shaft standard or  $\frac{3}{8}$  in. shaft optional  
Price each, without knob and dial .....\$2.25  
Same, with knob and dial ..... 2.75  
Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts 3.50



Most Jobbers and Dealers are now handling CROSLEY VARIABLE CONDENSERS. If yours does not, send order direct to us with his name and address. We will ship prepaid.

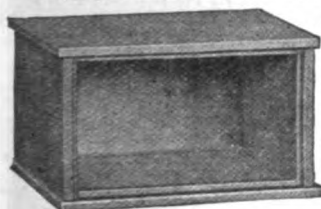
**CROSLEY MANUFACTURING COMPANY**  
Radio Dept. Q-8, Cincinnati, Ohio



# --More CROSLEY RADIO APPARATUS

"Better--Costs Less"

## Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbited in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finished. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

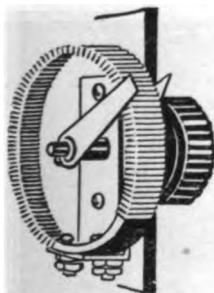
| For Panel Size | CABINETS Inside Dimensions |         |      | Mahogany or Quartered |        |
|----------------|----------------------------|---------|------|-----------------------|--------|
|                | High                       | Wide    | Deep | Gum                   | Oak    |
| 6x7            | 5 1/4"                     | 6 1/4"  | 7"   | \$2.50                | \$3.85 |
| 6x10 1/2       | 5 1/4"                     | 10"     | 7"   | 2.75                  | 4.40   |
| 6x14           | 5 1/4"                     | 13 1/4" | 7"   | 3.30                  | 5.55   |
| 6x21           | 5 1/4"                     | 20 1/4" | 7"   | 3.90                  | 7.30   |
| 9x14           | 8 1/4"                     | 13 1/4" | 10"  | 3.70                  | 6.80   |
| 12x14          | 11 1/4"                    | 13 1/4" | 10"  | 4.40                  | 6.80   |
| 12x21          | 11 1/4"                    | 20 1/4" | 10"  | 5.25                  | 10.60  |

Cash must accompany order. No C.O.D.'s. We pay transportation charges.

## FORMICA PANELS

We can furnish genuine formica panels 1/8" thick, cut to the following dimensions: 6x7; 6x10 1/2; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2 1/4c per square inch. For odd sizes order the next largest size; we will trim. We pay postage.

## CROSLEY RHEOSTATS

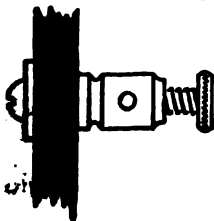


Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including 3/4"; non-corrosive resistance wire.

Model "A"—overall diameter 1 1/2". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60c each.

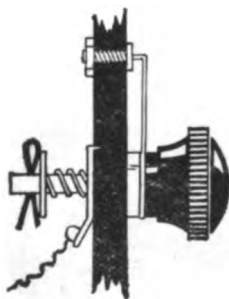
Model "B"—Resistance 4 ohms; will carry 3 amperes without heating. Suitable for detector, where very accurate adjustment is required and for 5 watt power tubes. Price \$1.25.

## CROSLEY BINDING POSTS



Barrel 3/4"x1 1/2". Not too small nor too large, just the right size.

Nickel plated. Complete with base screw and washer as illustrated. Price, 8c each or 90c per dozen.



## CROSLEY TAP SWITCHES

Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price 40c each. Better—Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut, 8c each, 80c per dozen or \$2.50 per hundred.

## CROSLEY VARIOMETER PARTS



This set consist of two stators, one rotor, the necessary hardware shown in the illustration. Shaft for knob and dial is 1/8" diameter. The wood parts are furnished either in poplar or mahogany.

The average radio man has his own ideas about the kind of wire and the number of turns that he wishes to use, depending upon its purpose, so we leave that to the purchaser. The operation of winding and setting up is very simple, but the parts that we list are difficult for the amateur to make. They are made in our own large wood working plant on special automatic machinery that make possible very accurate quantity production.

Price of Variometer parts, described above, made of poplar wood, is \$1.50 (including wood parts and hardware).

If wood parts are made of mahogany \$1.75.

If winding form is desired, it can be used for winding one or more variometers. Price is 30c additional.

## CROSLEY VARIOCOUPLERS



CROSLEY VARIOCOUPLERS consist of formica tube, rotor and brass hardware. It is made with the same care and accuracy as the CROSLEY VARIOMETER.

Price, complete as shown in the illustration, not wound or assembled, \$1.50. Stator, only 40c.

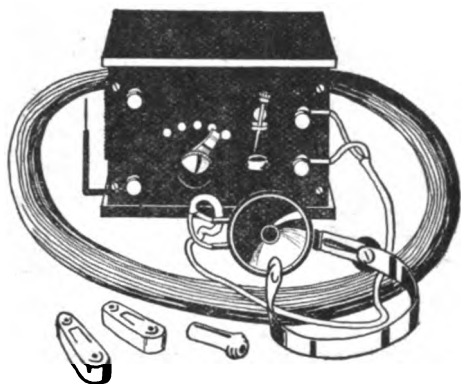
If your dealer does not handle any of the above parts, you may order direct. We will ship prepaid.

Dealers and Distributors: Every item shown above should be in your stock. Write for proposition.

**Crosley Manufacturing Company**  
Radio Dept. Q-8,  
Cincinnati, Ohio

# CROSLY RADIO APPARATUS

"Better—Costs Less"



## HARKO RADIO RECEIVER

The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire. Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. \$9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. \$8.00 extra. Complete outfit \$15.00. If your dealer cannot furnish, we will ship direct prepaid.

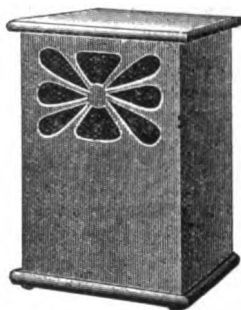
## THE CROSLY MAGFON

No radio station is complete without the CROSLY MAGFON—made to take any watch case receiver. Will radiate signals, phone music, voice, etc., all over the room or building. Enables a party of friends to enjoy wireless phone without the necessity of taking turns with head phones. Uses any single watch case receiver.

The MAGFON stands 12 inches high, is 8 inches wide and 8 inches deep, and comes in a dark antique mahogany finish.

Complete, ready for one of your head phones to be attached.

Price .....\$10.00



## CROSLY DETECTOR UNITS

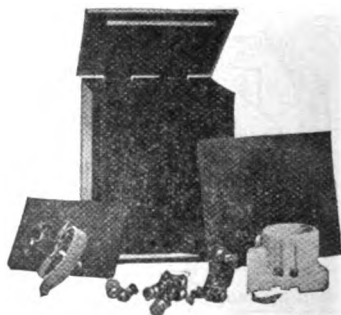


There are furnished in two ways:

Completely wired and mounted as shown on the left, or knocked down as shown on the right. Mounted—everything ready to hook to your set. Suitable for many different hook-ups. Formica panel: mahogany finished cabinet. Matches up with the CROSLY TWO STEP AMPLIFIER.

Price, completely assembled, as shown on the left.....\$7.50

Price of all parts, including formica or other panel of high grade dielectric composition, not drilled as shown on the right ..... 6.00



Size of the cabinet is 5½ in. long, 4½ in. deep and 6 in. high.

If your dealer cannot furnish any of the above units, we will ship direct prepaid, at the price. Dealers: Do not overlook the sales possibilities of the above units. Write for proposition.

# CROSLY MANUFACTURING COMPANY

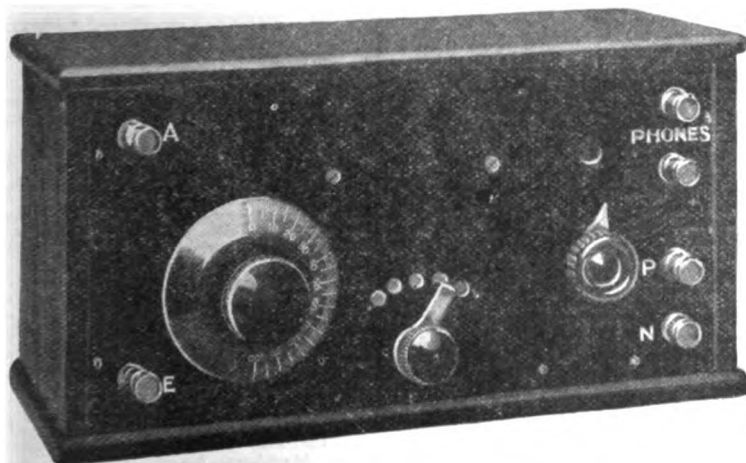
Radio Dept. Q-8,

Cincinnati, Ohio



# CROSLY HARKO SENIOR

## RADIO RECEIVER



The HARKO SENIOR was developed to supply the demand for a low-priced, efficient receiving outfit, having a range of from 150 to over 600 meters, thus bringing in on the average amateur antenna—amateur stations, radio telephones and commercial stations, operating up to and including 600 meters. Ships and stations on the Atlantic Coast are easily copied in Cincinnati. Radio telephone concerts and voice, from Newark, New Jersey and other New Jersey phones in addition to Pittsburgh and other phones, are regularly copied in Cincinnati. It is just the thing for receiving radio telephone concerts.

This instrument is a combination tuner and audion detector. It consists of a tapped inductance, a CROSLY VARIABLE CONDENSER, CROSLY Model "A" Rheostat, CROSLY V-T SOCKET, CROSLY GRID CONDENSER and Leak. The hook-up is special—of our own design and is now regenerative.

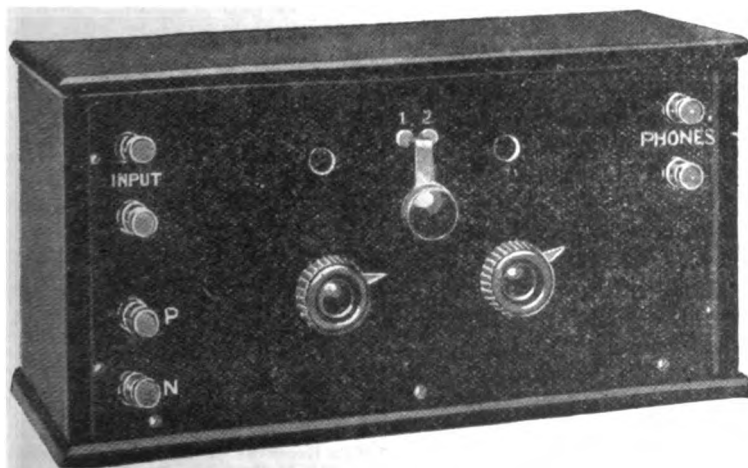
Parts are mounted on panel of formica or other similar dielectric composition. The whole thing is mounted in a mahogany finished cabinet 11½ inches wide, 6 inches high and 4½ inches deep.

This set is very efficient. The price is remarkably low.

The HARKO SENIOR is sold complete as described without tube, "B" Battery, "A" Battery or phone, as is usual with such apparatus.

PRICE .....\$16.00

## CROSLY TWO STEP AMPLIFIER



This instrument was designed to give the very maximum in value—to match up with the HARKO SENIOR, using the same sized cabinet. Complete with amplifying transformers, sockets, rheostats, switch, binding posts, etc. mounted on formica panel in mahogany finished cabinet. This instrument can be used not only with the HARKO SENIOR but with any other apparatus requiring two step amplifier.

Price, complete as shown in the illustration .....\$25.00

# CROSLY MANUFACTURING COMPANY

Radio Dept. Q-8,

Cincinnati, Ohio

# CLASSIFIED ADVERTISEMENTS

Five cents per word per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for succeeding month's issue.

It comes in like a ton of bricks thru the King "Amp-litons." See page 109.

**RADEX**—"Service That Satisfies." Prompt shipments, reduced prices, on all leading makes, from our large stock. Chi-Rad sets, \$6; bakelite panel 7x18 or 6x21, \$1.75; France battery charger, \$14; Detector tubes, \$4.50; Amplifiers, \$6; hand type microphone, \$5.40, panel type, \$3.60; receiving tube rheos \$0.65, power rheos \$0.65; storage B battery with charging rectifier, 32 volt \$7.50, 48 volt \$9.25, 66 volt \$11; mounted amplifying transformers, Thordarson \$3.75, A-A 10 to 1 ratio \$4.25, Acme \$4.75; 7-22 stranded aerial wire 100 feet \$0.70; bare tinned #14 copper one cent per foot, just the thing for bus-bar wiring; Square tinned bus-bar wire six cents per foot. Request bulletin. The Radio Exchange, Stroh, Ind.

**FOR SALE:** 1 KW Thordarson Transformer, Dubilier condenser, Benwood Gap, quarter horse induction gap motor, aerial switch, and OT. All practically new. Price \$100.00. 1/2 KW Packard transformer in oil, rotary gap, home made oil condenser, Price \$25.00. Ralph Lindahl, Bozeman, Montana, 7MP.

1 ACME double choke, 500 m.a., \$5.00; 1 Clapp-Eastham B-Q wavemeter, \$20.00; 1 Crocker-Wheeler generator 500 volt D.C. 500 watts, with field rheostat, \$40.00; Lot of assorted mineral rocks from all parts of world, with chemical analysis, \$5.00; 1 open core transformer with rheostat, gives 8 inch spark, 3 variations of power, made by E. B. Meyrowitz, \$30.00; 1 DeForest 15 panel honeycomb coil receiving set in cabinet, A. battery potentiometer and 2 step \$100.00. Write 3HB.

ACME-200 watt C.W. trans. \$12; 50 watt, \$9; 150 watt filament heater, \$10; 2 A.P. rect. tubes, both \$10; 4 Murdock moulded condensers, \$2 each; 4 DeForest Amp. trans. \$4 each; Emerson 3400 rpm. induction motor 1-12 hp. \$13. Harold Newman, Radio 9QH, Danville, Illinois.

5% DISCOUNT on all apparatus. Cash with order plus postage. Order from advs. or catalogs. We specialize on delivery service and progressiveness—If it's on the market you can get it from us. Radio Mail Order Co., Brookline, 46, Mass.

**FOR SALE:** 1 KW "H" Thordarson Transformer; 1 KW Oscillation Transformer; Spark Gap and Motor; No. 2 Jr. Omnigraph and dials; Hot Wire Ammeter; A.C. Ammeter and Voltmeter. Cheap for cash. W. A. Neff, 216 Maumee Ave., Grosse Pointe, Mich.

SEE THIS all new apparatus—1-1800 rpm. synchronous motor, \$25.00; 2 Federal Amp. transformers, \$10; 2 Detector tubes, \$5.00. All of this apparatus never used. Carl P. Goetz, 1128 Atwood Ave., Cincinnati, Ohio.

**AGENTS WANTED** in every community to sell "Work-Rite Receiving Sets" at \$6.00 complete. Every boy wants one. Works perfectly. Chance to earn good money. WorkRite Mfg. Co., Cleveland, Ohio.

**FOR SALE:** One 1/2 KW Clapp-Eastham "Hytone" sending set. This comprises Transformer, 1/2 KW 110-115 volt, 60 cycle, one rotary quenched gap, "Semi synchronous" motor, Oscillation Transformer, Condenser and antenna switch on marble base. This set mounted in golden oak cabinet and in A-1 condition. Set has radiated 3 Amps. on Antenna of .001 Mf. capacity. Hickson Electric Company, Inc. "Radio Shop," 11 Corinthian Street, Rochester, N. Y.

**TELEPHONE** and musical concerts. If you want to hear them get our simple diagram and hook up advertised this issue under classified advertisement. Virginia Novelty Co., Martinsburg, West Va.

**HEARD 2,300 miles!** IBM's Set For Sale! Consists of: United Wireless Coffin Transformer; Dubilier .01 25,000 volt Condenser, latest type; Hy-Rad Rotary Enclosed Gap, without motor; Heavy O.T.; United Wireless change-over Switch. Good bargain for Quick Buyer. Price \$115. H. E. Nichols, 513 Pequonnock St., Bridgeport, Conn.

**FOR SALE:** Navy Type loose-coupler, fine condition,

\$14.00 prepaid insured. Marvin Kershner, 832 Hamilton Ave., Flint, Mich.

**FOR SALE:** DeForest honeycomb coils, 1 KW Bunnell key and Jewell milliammeter. All in A-1 condition and very cheap. Write to Jerome Solomon, 892 Union Avenue, New York City.

**TERRESTRIAL TELESCOPE**, \$40.00. Want wireless goods, or anything. Wantaya, 1659 Buena Vista, Detroit.

**CQ1 SALE**—1/2 KW quenched set cheap at \$50. Range 500 miles or better, F.O.B. SAYM, 78 Newton, Jamestown, N. Y.

**"ARKAY"** Radio Horns; black \$4.50, nicked \$5.25. Order today for immediate shipment. Jennison, 63 Russell Street, Waltham, Mass.

**WANTED:** 3600 synchronous motor, Jewell 0-10 ammeter. Carl Whittington, West Main Street, Benton, Illinois.

**THORDARSON 1/2 KW;** Murdock O.T., Six sections Murdock moulded condensers, Rotary, \$40. New. George Hunter, St. Johns, Mich.

**WANTED:** To exchange all kinds of new and used apparatus. Let us know what you have and what you can use. Satisfaction guaranteed. The Radio Exchange, Stroh, Ind.

It isn't a **LOUD TALKER** if it isn't a King "Amp-litons," see page 109.

**FOR SALE:** Slightly used 500 Volt-100 watt Peerless generator also Arlington loose coupler, cheap. J. P. Hyde, Markham, Va.

**FOR SALE:** 1 Acme 1/2 KW Transformer, \$15; 1 3400 rpm. Motor with Disc, \$20. Oil immersed condenser, \$5.00. 1404 Michigan Ave., Manitowoc, Wis.

**32V—1 KW Spark Set** \$48, worked 1000 miles, 3000 meter regenerative receiver and detector \$30. Long wave receiver and bulb \$22. Sam Place, 622 Stanbridge St., Norristown, Pa.

**FOR SALE:** Regenerative Receiver with one-step complete, \$45. Murdock Phones and Variable Condenser \$5, 1 inch spark coil with transmitting key \$5. E. Schuessler, 2209 Wheeler St., Cincinnati, Ohio.

**FOR SALE:** Glass plate condenser, quarter inch thick, in oil, rotary gap, Benwood renewable disk complete, homemade O.T. \$20. Brandes transatlantic phones \$5.00. B. Hampe, 1228 Putnam Ave., Brooklyn, N. Y.

**REASONABLY PRICED**—Long life—Satisfactory service. Use Flashlight batteries for plate voltage. Set of 10 (shipping wt. 4 lbs) batteries 45V. \$3.00; 5x7 glass plates for condensers, 1c each. Tarr Studio, 20 E. 14 St., N. Y. C.

**FOR SALE:** 1/2 Kilowatt Packard Transformer, \$15.00; Unused Amrad Quenched Gap, \$13.00; Murdock Hinged Oscillation Transformer, \$2.50; Home made Condenser, glass dielectric, oil-immersed, \$7.50. Write V. Thiemann, Baraboo, Wis.

**WANTED:** Loudspeaker or C.W. apparatus for Goodell-Pratt Bench Lathes." Dan Lake, Lake City, Kansas.

**TELEFUNKEN AND FESSENDEN** 1/2 KW 500 cycle transmitters, complete; motor generators; Navy material. Henry Klenzie, 501 East 84th St., New York.

**WOOD VARIOMETER** parts complete including winding form, not wound \$1.80, wound \$3.25; variocoupler parts not wound \$1.40, wound \$3.00. New silent bearings. Special price on complete outfit, not assembled. Cabinets and wood parts made to order. Send specifications. Alan W. Hotchkiss, 28 Locke St., Ansonia, Conn.

**SACRIFICE:** Excellent 1/4 HP. Sink Gap, complete \$28. C. Gielow, 218 McDonough St., Sandusky, O.

**HEY BUGS!** Practically new, used 2 months; Thordarson Transformer, new type, \$25.00; Benwood synchronous, \$45.00; Benwood glass plate condenser, \$27; Thordarson O.T., \$6.00; 10 amp. Jewell motor, \$10; If sold complete, \$100.00. Carl P. Goetz, 1128 Atwood Ave., Cincinnati, Ohio.

**STOP! LOOK! and ACT!** V-T's and accessories! With

each of the listed tubes Radiotron UV-200 \$5.00 and A.P. detectors \$5.00; Radiotron UV-201 \$6.50 and A.P. amplifiers \$6.50; We will supply free of charge your choice of either of these five premiums—Latest FADA Rheostat \$1.00, No. 810 Remler Bakelite Smooth Running Rheostat \$1.00, Paragon V-T Socket \$1.00, Murdock V-T Socket improved contact type \$1.00, or CROSLY Porcelain Panel or Base Mounting V-T Socket, \$0.60. Either of the Federal single, closed or double circuit jacks listed respectively at \$0.70, \$0.85 and \$1.00 will be given as premiums with each Federal 226W Amplifying Transformer \$7.00 or R. C. of A. UV-712 \$7.00 and the UV-1714 Radio Frequency Amplifying Transformer. FADA 5 ampere Nichrome Power Rheostats \$1.35 or R. C. of A. UR-542 Porcelain V-T Socket supplied free of charge with each \$8.00 UV-202 5-watt Radiotron Power Tube, for C.W. or Radiophone Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Twelve hour service. Postage and insurance prepaid by us, thereby saving time and money. Remember us. The Kohler Radio Laboratories, Dept. Q, Abilene, Kansas.

9AAW's 1 KW "Coffin." Was heard in Mexico, Canada, and every state in Union save California \$50.00. OT. 2<sup>nd</sup> Pri. 1 1/4" Sec. Bakelite insulation. Designed especially for "Coffin", \$10.00. C.W. Inductance, 1/4" Ribbon \$4.00. Single W. E. cone with head-band \$4.00. C.W. Chopper wheel and brushes, 20 contacts \$4.50. Karl Niskanen, 8AN, 12043 Cloverlawn Blvd., Detroit, Mich.

FOR SALE: Old type Clapp-Eastham 1/4 K.W. transformer \$9.50. Lawrence Smith, Osage, Iowa.

FOR SALE: 9AEQ's Benwood sink gap, aluminum type, very slightly used \$60.00; One Jewell thermo-couple ammeter 0 to 10 amps. \$13.00; One very large OT. \$16.00; also one glass plate condenser oil immersed \$16.00. All in perfect shape, 9AEQ.

ORDER YOUR MAGAZINES thru me. I am confined to a wheel-chair and am agent for all magazines. Write for club rates. Lowell Martin, 911 North Tenth St., Lafayette, Ind.

FOR SALE: Navy long wave receiving set, also navy low power motor boat transmitter. Full description upon request. R. S. Miner, 68 Quaker Lane, Hartford, Conn.

FOR SALE: Paragon R.A.-6 \$25.00; Clapp-Eastham Kernal Hot Wire Meter with shorting switch \$8.00. Clapp-Eastham Antenna Switch \$5.00. Apparatus in A-1 shape. Clayton LeGallier, Slingerlands, N. Y.

SELL: 48 Acme, 40 Dubilier .007, 25 Cap. 5 OT. etc., all for \$50. All in finest condition. F. Schmitz, 429 N. Central Ave., Chicago.

NOTHING TO SELL, but do you like SUX's cartoons in QST? Suggestions and ideas gladly received. A postal will do. D. A. Hoffman, SUX, 318 Ohio Bldg., Akron, Ohio.

GET THAT Synchronous Tone. 1/2, 1-5 and 1/4 HP. 220 and 110 volt synchronous motors suitable for gaps at very low prices. Stahl Rectifier Company, 1401 W. Jackson Blvd., Chicago, Ill.

Compare it and you will buy the King "Amp-li-tons." See page 109.

EDISON B Battery elements. Make your own. Can be recharged and lasts for years. Harry Morrell, 52 Goffe St., New Haven, Conn.

GENUINE MARCONI RECEIVER, like new, complete with bulbs, \$75.00; also small crystal set \$8.50. Box 1504, Providence, R. I.

FOR SALE: 8QC's Spark Transmitter, 1KW Type R Thordarson, Benwood Super Gap with motor, Plate glass oil condenser, Oscillation Transformer. Complete, \$75.00. DX record 1500 miles. Robert Emery, Grove City, Penna.

GOVERNMENT RADIO APPARATUS cheap .0035 Mf. Dubiliers \$6.00; 1/2 KW quenched gap \$6.50; hard rubber jars suitable for rectifier @ \$0.25; 2 KW 500 cycle transformer \$18.50; 1/2 KW 500 cycle ship set complete \$110.00; 1/2 KW French army portable \$45. Other bargains. Eaton, 1915 South 12, Phila., Pa.

SAY MEN you will hear 5ZQ and 5PG this month.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Write him in your call book as W. H. England, Ponca City, Oklahoma.

BKUMA YRLSBUG. Two hundred beginners tell how memorized Wireless Code in 30 minutes to two hours. Booklet 10 read stamps. Dodge, Box 210 Mamaronock, N. Y.

CHEAP: Honeycomb Coils; Spider-web Coils; Filament ammeter; Antenna switch. Kary Canatsey, 202 E. Jackson, Iola, Kansas.

WANTED: Grube Unit type RORH. Dr. F. C. Cave, Grainfield, Kansas.

FOR SALE: Station 9DFX. Includes Acme 1 KW and 2-step amp. Roy Conibear, Amboy, Ill.

AMATEURS: Send 50c for rubber stamp of your station call in large letters, and circulars illustrating other stamps and samples of Radiogram blanks, postal card, etc. Carolina Printing & Stamp Co., Wilmington, North Carolina.

SALE OR EXCHANGE: 1 KW United Wireless 30,000 volt "coffin," \$30; six .004 mfd. 12,500 volt mica condensers at \$6; synchronous gap (Hydrad rotor on 1/4 HP. motor) (rocker arm) \$20; in use at 1CK; 0-25 ampere Weston A.C. meter, \$10. Miscellaneous: Want 1 HP. 60 cycle motor, or gas engine to drive 1/2 KW 500 cycle motor generator or Westinghouse receiver or power tubes. Cumming, 83 Marlboro Street, Boston, Mass.

SELL: Regenerator and Long-wave coupler, \$15. Write Horace Crawford, Oida, Iowa.

DUBILIER CONDENSER .007, 21,000 Volts \$23.00. Omniograph 5 Dial \$6.00. Henry L. Bantelman, Jr., 300 Tuckahoe Rd., Yonkers, N. Y.

RADIO BARGAINS: 50c EACH POSTPAID. Phone plugs; 3 contact Jacks, work either open or closed circuit; Receiving Station Lightning Arresters, carbon gap with high voltage fuse, on porcelain base, \$1.00 value; Bakelite 3" diameter tubing, per foot; Ward Leonard resistance tubes, up to 2000 ohms; Non-inductive Alloy Wire Resistance units on wooden spools, any resistance up to 2000 ohms; Six feet 25 Ground Wire flexible 61 strand R.C.; Postage not paid on wire. D.C. C. Enam. \$14 Copper wire, 40c pound. Miscellaneous Bargains—Change-Over Switches, for panel mounting with knob, Six pole, D.T. \$2.00 each; same, 2 P. D.T. \$1.00; same, Single pole D.T. 60c; Wheatstone Bridge Resistance Boxes, with plugs, 6 circuits, \$4.50 F.O.B. Chicago. Twelve hour service on all above. American Radio Supply, 21408 So. Harding Ave., Chicago, Ill.

CLAPP-EASTHAM ROTARY, two .004 Dubiliers and 1/2 KW Transformer \$60.00. M. Liederer, 61 Cornellison Ave., Jersey City, N. J.

WANTED: A few Western Electric VT-1's, VT-2's and Receivers for use in our laboratory. Must be in good operating condition. State quantity and lowest price. Reading Radio Shop, Box 6, Reading Massachusetts.

FOR SALE: Receiving apparatus, Amrad Short Wave Regenerative. Edison Storage Batteries—180 amp. R. O. Wahlmann, 3257A California, St. Louis, Mo.

FOR SALE: 1/2 KW Thordarson Transformer, \$17.00; 1/2 KW 14,000 volt Dubilier, \$24.00; 220 volt D.C. motor, \$17.00; 20,000 meter Treco tuner, \$7.00; 2 variometers, \$7.00; Thomas G. Walde, 21 Woodbury St., Beverly, Mass.

FOR SALE: DeForest unit set, special, 15 panels including detector and 2 step, vernier type condensers, Tuska plate variometer, variable grid and plate condensers, complete with Radiotrons, phones, B batteries, coils, etc., all in fine mahogany cabinet and practically new. Cost \$200. First check for \$135.00 takes it. Harry W. Thomson, Millbury, Mass.

STORAGE BATTERIES: 6 volt 80 Amp. IDEAL guaranteed lighting batteries. Factory to you \$15.00. \$4.00 cash with order, balance C.O.D. We are Westinghouse agents for the Northwest. St. Paul Electric Co., St. Paul, Minn

LIBERTY C.W. Transformers, chokes, condensers, other transmitting and receiving products. Guaranteed. Write. Dealers Wanted. Snyder Radio Manufacturing Co., Ashland, Ohio.

## Radio Apparatus and Electrical Equipment of All Makes for the Amateur and Experimenter

### PHONES

|                         |         |
|-------------------------|---------|
| Baldwin C .....         | \$12.00 |
| Baldwin D .....         | 13.00   |
| Baldwin E .....         | 14.00   |
| Federal 2200 Ohms ..... | 8.00    |
| Federal 3200 Ohms ..... | 10.50   |

### JACKS

|                                |        |
|--------------------------------|--------|
| Federal #1421-W .....          | \$0.70 |
| Federal #1422-W .....          | 0.85   |
| Federal #1423-W .....          | 1.00   |
| Filament Con. #1435-W .....    | 1.20   |
| Filament Control #1438-W ..... | 1.50   |

### CONDENSERS

|                                     |        |
|-------------------------------------|--------|
| Chelsea unmounted .00055 .....      | \$4.25 |
| Chelsea unmounted .0011 .....       | 4.75   |
| Coto-Coil 15 plate mtd. ....        | 9.50   |
| Coto-Coil Unmounted 15 plates ..... | 4.50   |
| Coto-Coil 23 plates mtd. ....       | 10.00  |
| Coto-Coil unmounted 23 plate .....  | 5.00   |
| Coto-Coil 33 plate mtd. ....        | 11.00  |
| Coto-Coil unmounted 33 plates ..... | 6.00   |

### TRANSFORMERS

|   |        |
|---|--------|
| Coto-Coil Radio Frequency .....         | \$5.50 |
| Coto-Coil Audio Frequency .....         | 5.00   |
| General Radio Audio Frequency .....     | 5.00   |
| Federal Audio Frequency .....           | 7.00   |
| Chelsea Audio Frequency .....           | 4.50   |
| Chelsea unmounted Audio Frequency ..... | 3.75   |
| Federal Power Transformer .....         | 32.00  |
| Acme Power Transformer 50 watt .....    | 16.00  |
| Acme Power Transformer, 200 watt .....  | 20.00  |

### LOUD SPEAKERS

|                        |        |
|------------------------|--------|
| ARKAY Radio Horn ..... | \$5.00 |
| Plethophone .....      | 14.00  |
| Vocaloud .....         | 30.00  |
| Magnavox .....         | 45.00  |

### RECEIVING SETS

|                                 |         |
|---------------------------------|---------|
| Aeriola Jr., Crystal .....      | \$25.00 |
| Amrad Crystal .....             | 21.50   |
| Westinghouse Rec. ....          | 68.00   |
| Westinghouse Det. 2 Stage ..... | 68.00   |
| Grebe C.R.-5 .....              | 80.00   |
| Grebe C.R.-9 .....              | 130.00  |

Orders for above goods will be shipped immediately upon receipt of money order, or by parcel post C.O.D.

**JAMES H. JONES**

Radio Apparatus

94 Massachusetts Ave., Boston, 17, Mass.

**WANT TO SAVE MONEY?** Then get our prices on guaranteed used apparatus. Tell us what you need. We have it. The Radio Exchange, Stroh, Ind.

**TELEPHONE AND MUSICAL CONCERTS** with a Single Bulb. Are you satisfied with your receiving set? Would you like one that will receive 6,000 miles? Would you like to build a simple one and quit experimenting? One using parts you already have and that will be the equal of any regardless of claims or price? If so, get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, South America, German, French and English stations, and practically all the high powered foreign and domestic stations, with a single bulb. Amateurs as far west as New Mexico and numerous telephone and musical concerts come in good. Diagram and complete instructions, leaving nothing to guess about will be promptly mailed for fifty cents in coin or stamps. Virginia Novelty Co., Martinsburg, West Va.

The **PRICE** is **RIGHT** and is based on quantity production, it's up to you "SPARKS." Send in that "TWELVE." Quick delivery. King "Amp-li-tone." See page 109.

**OMNIGRAPH** No. 2, 10 dials, \$12; \$22 Duck Loose Coupler, \$14. Both like new. K. O. Broady, Lincoln, Kansas.

**Q.R.A. de 9LE**—C. W. Breestle, 137 W. 28th St., Indianapolis, Indiana.



### PANELS CUT TO ORDER --- A NEW SERVICE

We cut panels to exact size from Bakelite 1-16 to 3/8", Formica 1-16 to 3/4", Fibre 1-16 to 1/2" thick.

Drilling Holes up to 1/2" @ 3c each.

Engraving—Letters or figures—5c each, 180 scale—75c each.

### A NEW WIRELESS LOOSE LEAF CATALOG

Send 10c, stamps or coin—100 pages all wireless sending and receiving sets. You get regular up-to-date radio bulletins.

The KUEBLER RADIO Co.

123 Boody Bldg.

Toledo, Ohio

## WIRELESS TELEPHONE AND RADIO APPARATUS

(Complete Sets)

### CLARK & MILLS ELECTRIC COMPANY

ELECTRAGISTS

75 Newbury St., BOSTON

Tels. Back Bay 365 & 366 & 8296

1444 Massachusetts Ave., CAMBRIDGE

Tel. University 1169

### Ess-Are-EI

You can save money by dealing with the Ess-Are-EI. We carry a stock of all the latest and best types of radio apparatus. We also build instruments to your order.

### THE

## STURGIS RADIO LABORATORY

STURGIS, MICHIGAN

Radio SCHK

### RADIO SPECIAL

### STORAGE BATTERIES

|                         |         |
|-------------------------|---------|
| 6 Volt, 40-60 amp. .... | \$10.00 |
| 6 Volt, 60-80 amp. .... | 12.00   |

Fully Charged. F.O.B. Boston. No charge for Crating. Brand New; Guaranteed One Year.

Manufactured By

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336 NEWBURY STREET, BOSTON, MASS.

### PRACTICAL COIL AERIAL DATA

Eliminate that QRM; receive... on an indoor coil aerial. Knowing the maximum capacity of the variable condenser you will use across the coil terminals, the curves and tables we have compiled enable you to construct a coil of proper number of turns for any wave-length. Charts covering 0 to 3600 meters 50c. 3600 to 24000 50c. Stamps not accepted.

C. A. DAVIS COMPANY

2371 Champlain N. W., Washington, D. C.

## DESIGN CONSTRUCTION REPAIR

Service for the Amateur

Beginning January first 1922 a test curve will be furnished free of charge with every UV200 and 201 Radiotron Tube purchased from us.

New England Radio Engineering Co.

380 LaGrange St., Boston 32, Mass.

## RADIO CONSTRUCTION CO.

Manufacturers of all kinds of Wireless Telephone and Telegraph apparatus. Panel drilling and engraving a specialty. Binding Peats, stops, switch points, nuts and screws of all sizes.

42 Maverick Square

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—FOR YOUR CONVENIENCE—

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# Complete outfits to receive the WIRELESS TELEPHONE CONCERTS

In response to the tremendous new interest in wireless, created by the sweep of broadcasting stations all over the country, many styles of complete ready-to-operate outfits have been developed. Continental has carefully selected certain of these sets, of a wide price range, which combine efficient service with simplicity of operation.

The "Marvel" set at \$15.00 complete is truly "The Marvel of Radio". Within 25 or 50 miles of a powerful broadcasting station, you can hear concerts clearly on a Marvel set. It requires no knowledge of radio whatever, and is so simple to install that you cannot go wrong.

Another low priced but entirely satisfactory set is the Westinghouse Aeriola Jr., at \$25.00. This is an easily adjusted crystal detector set purposely designed to receive the broadcasting. It is so simple to operate and the instructions are so clear that it is practically fool proof. The Westinghouse reputation is back of this efficient instrument which will be found unexcelled for distances of 40 to 50 miles from a broadcasting station. The price of \$25.00 includes head phones. The only extras you will need are included in our Antenna equipment Number 1 at \$2.00 complete. Thus for \$27.00 you can get an outfit complete in every detail. You can put it up in one afternoon and listen to concerts that same evening.

To receive longer distances, it is, of course, necessary to have vacuum tube equipment. Most vacuum tube sets are complicated and require considerable technical knowledge. This objection is overcome in the Westinghouse Aeriola, Sr. This set employs the Armstrong regenerative circuit, and includes a vacuum tube detector in one handsome, portable cabinet. This outfit, which is far more sensitive and has considerably longer range than the Aeriola, Jr., comes to you complete for \$75.00.

For those who want a longer range, powerful and highly efficient set including a loud speaker, we recommend the following outfit: a Grebe CR-9 receiver, which includes vacuum tube detector and two-step amplifier equipment, one Radiotron detector tube, two Radiotron amplifier tubes, one pair of Baldwin type "C" phones, one Radio Magnavox, 3 "B" Batteries, and one storage Battery. This set has a range of 750 to 1000 miles. Under normal conditions

you can hear voices and music by wireless telephone clearly 25 to 50 feet from the loud speaker. It is unusually simple to install and operate. Simply connect your Antenna and ground connections, insert tubes, hook on batteries, and you are ready to listen. The price of this outfit as listed above is \$246.00.

For those who want the limit of perfection, there is the Paragon R.A. Ten, for which we are sole wholesale distributors. Many prominent amateurs who have tested Paragon R.A. Ten unanimously report that it is "unexcelled for C.W. (telephone) reception". This receiver employs the Armstrong Regenerative Circuit and is 24 per cent more sensitive and selective than its famous predecessor—Paragon R.A.-6. And the now low price of \$69.50 makes Paragon R.A. Ten a remarkable value.

For a complete set built around the Paragon R.A. Ten receiver we recommend the following additional equipment: one \$65.00 Paragon DA-2 amplifier cabinet, 3 vacuum tubes, 3 "B" batteries, one storage battery, one pair of Baldwin Type "C" phones, a radio Magnavox and our number 3 Antenna Equipment. This entire equipment, which gives you a set fully equal in results and appearance to a high class commercial receiving station, is priced at \$258.50 complete.

In addition to the sets described above, we also recommend complete sets built around the deForest "Everyman" set at \$25.00, the Clapp-Eastham type H-R receiver at \$35.00, and the AcmePhone at \$80.00. Descriptive literature on request.

If you can visit the Continental Store in New York, by all means do so. Come in and listen to the different sets in actual operation. Let our salesmen, who are experienced Radio operators, help you select a set which meets with your particular requirements.

If you live farther away, our mail order department is prepared to serve you efficiently. Any of the complete sets described above will be shipped to any part of the United States by express, immediately.

If you do not wish to order at once, let us send you our new folder "Music from the Clouds" which illustrates and describes in detail five complete ready-to-operate outfits. It is absolutely free. Drop a post card for your copy today.

## CONTINENTAL RADIO AND ELECTRIC CORPORATION

Dept. B3,

6 Warren Street,

New York City

*"New York's Leading Wireless House"*



## New Radio Receiving Set *TYPE JR-3*

This new set employs a CONNECTICUT Vacuum Tube for detection, and offers a moderately priced receiving set with exceptional qualities of selectivity and sensitiveness. It is designed primarily for the novice, and may be successfully operated by those with limited radio experience.

## A New CONNECTICUT Detector Unit

This unit is designed to use a CONNECTICUT Vacuum Tube; and as a *detector* will give a strong signal. It receives signals without squeals.

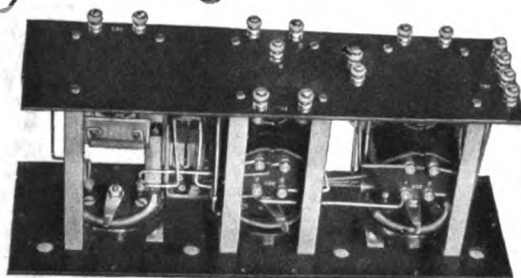
Information on these new products will be found in our new bulletins, A8 and A9.

Ask your dealer to supply your wants on CONNECTICUT apparatus.

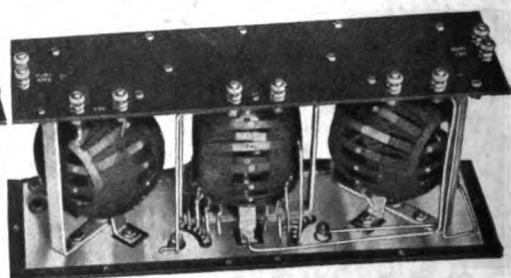
 **CONNECTICUT** Meriden **TELEPHONE & ELECTRIC COMPANY** Connecticut 

# AMRAD

*The Recognized Symbol of Superior Performance*



Detector 2-stage Amplifier 2634



Short Wave Tuner 2596

## Look Behind the Panel

Experienced motorists, before purchasing a new car, critically examine the power mechanism. **THEY LOOK UNDER THE HOOD.** Skilled radio men—QST readers—before passing judgment on the merits of a new set, **LOOK BEHIND THE PANEL.** In the Amrad designs they find the celebrated Basketball Variometer, variable vernier inductances, terminals for load coils, aluminum frame construction, rear connections and shielded Ampliformers.

In the Amrad Short Wave Tuner they find an instrument which will **TUNE DOWN** to 165 meters. In the Amrad Detector 2-Stage Amplifier they find precise plate voltage regulation.

No wonder these highly developed instruments in combination have become a national favorite for the reception of telephone broadcasting and "DX" relays." The solid mahogany cabinets and the lustrous finish delight the eye, but the actual performance thrills the soul.

We encourage relay men to adapt our designs to instruments of their own building. Essential parts of the above combinations are now available. Ask for Forms 299 and 300 if interested.

*Complete description in Bulletin L-1  
sent free on request.*

**Complete Amrad Catalog 10c stamps.**

## AMERICAN RADIO AND RESEARCH CORPORATION

205 College Avenue  
**MEDFORD HILLSIDE, MASS.**

New York District Office  
13 PARK ROW

Chicago District Office  
602 SO. DEARBORN ST.



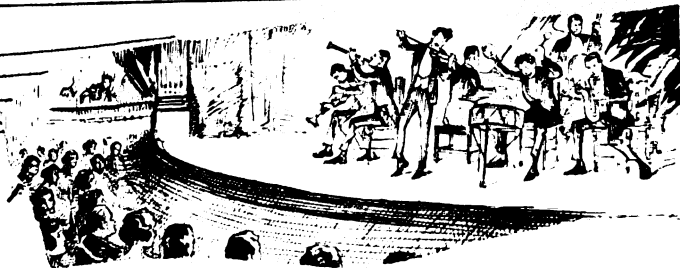
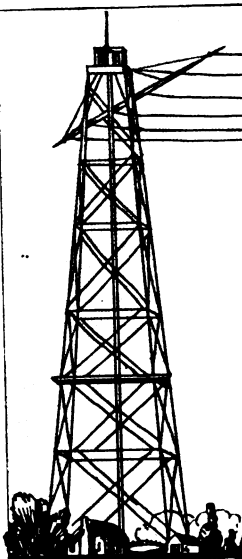
# QST

*A Magazine published by the  
American Radio Relay League  
and devoted exclusively to*  
**CITIZEN RADIO**



**APRIL 1922**  
**20¢**

*Hyde Park*  
**8ZZ**



## RADIO BROADCASTING

It is not at all unusual that local amateurs, newly interested in Wireless, through the Broadcasting, should prefer Atlantic service. But, when orders come from Pittsburgh, New York, the Middle West; in fact, from all over the country, there must be some reason.

We specialize in standard apparatus that can be purchased anywhere. The only possible advantage that makes thousands of amateurs prefer to deal with Atlantic is in the service they receive.

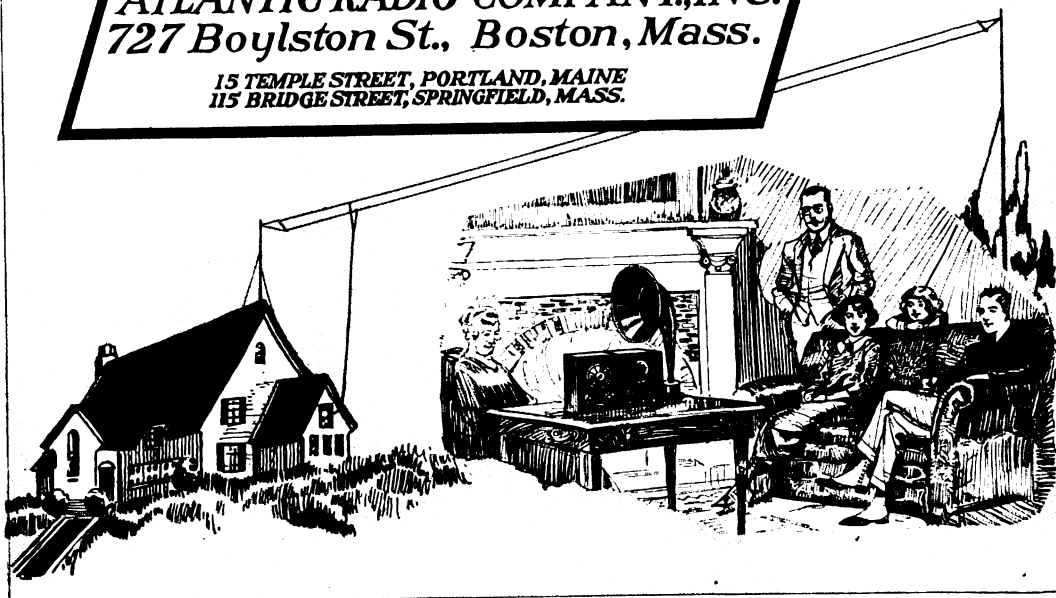
Of course, we have established a reputation for answering all inquiries frankly and promptly. When we offer suggestions to a customer, we never recommend an expensive outfit when a \$25.00 or \$50.00 set will meet his particular needs. Many customers leave the entire choice of their equipment to us and in every case, they have expressed complete satisfaction with our choice.

We have prepared three Bulletins, 19, 20 and 21 which describe a wide choice of standard equipment to receive wireless telephone broadcasting. These will be sent free on request to any reader of QST.

The Radio Corporation's "C.W." manual and catalog 25c. per copy.

**ATLANTIC RADIO COMPANY, INC.**  
**727 Boylston St., Boston, Mass.**

**15 TEMPLE STREET, PORTLAND, MAINE**  
**115 BRIDGE STREET, SPRINGFIELD, MASS.**



# RAC-3 AUDION

**Price**  
**AUDION**  
**and**  
**Receptacle**  
**\$4.50**



**AUDIO**  
**FREQUENCY**  
**AMPLIFIER**  
  
**RADIO**  
**FREQUENCY**  
**AMPLIFIER**  
  
**AUDION**  
**OSCILLATOR**

## Full Size FIRST UNIVERSAL AUDION

Manufactured under DeForest Patents No. 841,887 and No. 879,582

# Radio Audion Company

**90 Oakland Avenue,**

**Jersey City, New Jersey**

RAC-3 Audions are interchangeable without necessitating critical readjustments.

RAC-3 Audions are not critical to A or B battery adjustments.

Low battery consumption. Filament current 0.8 amp. at 4 volts, maximum. Plate voltage 2 to 22 volts.

Clear signals and great sensitiveness on long distance reception.

Perfect oscillation for use in regenerative circuits.

Small size. Rigid construction. Non-microphonic. No tube noises due to mechanical vibration.

Maximum insulation between filament plate and grid terminals resulting from new type of tube and receptacle.

Maximum direct mechanical contact between audion leads and receptacle clips.

Audion base caps and Receptacle block moulded Grade A Condensite.

Receptacle block is designed to permit built-up panel construction for amplifier panel. Circuit connections may be made from front, back or sides.

### NOTICE

This tube is not sold or purchased to be used as a detector of wireless waves. Any use or sale of it for such use renders the vendor or user liable to prosecution for infringement of patent. This tube is sold for use in tandem with another device acting as a detector for the purpose of amplifying either radio or audio frequency currents or as a generator of high frequency electrical oscillations.

After November 7th, 1922 the RAC-3 Audion will be available as a Detector and no longer limited for use in tandem with another device acting as a detector.

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# Build Your Own Radio Tower

**THINK** of the benefits and pride you would enjoy by having a real radio tower right on your own grounds. Think how much better you could hear and how much further you could send. Think how your reputation as a radio operator would travel through your community!

You can now build a tower yourself from standard materials which are all sold by your local dealers—build it from 40 to 100 feet high—economically and safely—from the easy-to-understand Hull blueprint plans that are as simple as A-B-C.

## CORRECT PRINCIPLES

For years we have been building heavy transmission towers for big central stations all over the country. Now we have started a department to permit radio operators to have the benefit of our tower building experience. At great expense we have drafted simple, yet detailed architects' blueprint plans for radio towers of seven popular heights. Every problem is properly covered—foundations, weights, stresses, wind pressures, etc. You do not have to figure out any sizes or what to use. Everything is shown plainly, right down to where and what size to bore the holes.

## YOU SAVE MONEY

Our plans call for everything that is best for strength, yet cheapest to use; you waste no money on useless parts. And, of course, because you build the tower yourself it costs you but a fraction of what you would pay for one ready-made.

## SIMPLE TO ERECT

The erection of your tower is simplicity itself. No long, awkward, heavy pieces are used; everything is light, strong and easy to handle. After cutting the pieces to size and boring the holes, you start building up and up, merely bolting each piece into position. You number each piece as you

make it, according to blueprint numbers—you can't go wrong. To the operator who likes to make things, building this tower will be real sport.

## SPECIAL OFFER

As a special introductory offer, for a limited time we have reduced the prices of all Hull radio tower working blueprint and erection diagram outfits exactly 50%:

40-ft. and 50-ft. Hull Tower Plans,  
regularly \$ 4.00—special \$2.00  
60-ft. and 70-ft. Hull Tower Plans,  
regularly \$ 7.00—special \$3.50  
80-ft. and 90-ft. Hull Tower Plans,  
regularly \$10.00—special \$5.00  
100-ft. Hull Radio Tower Plans—  
regularly \$12.00—special \$6.00

All orders filled promptly upon receipt of money-order or draft; send letter registered if it contains currency. Select the size tower you want to build and order the plans now.

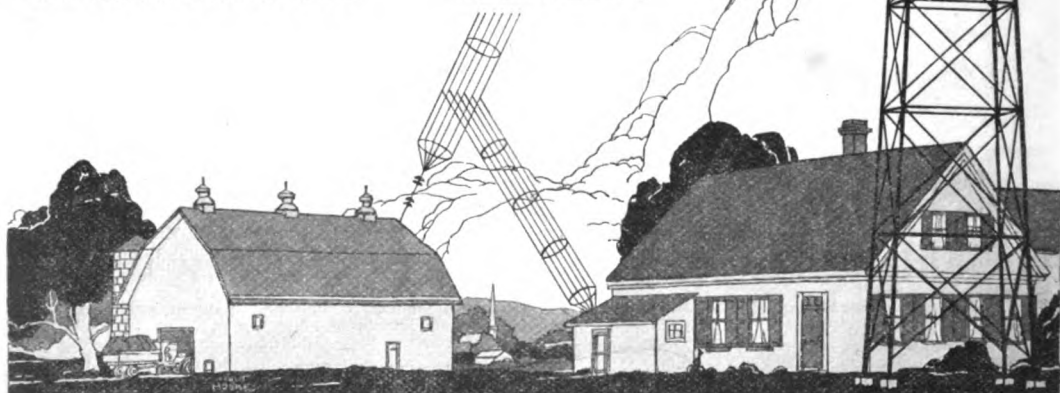
## S. W. HULL & COMPANY

*Steel Tower Specialists*

General Offices

3729 Prospect Ave. Cleveland, Ohio

Address Department Q



# HULL

# RADIO TOWERS

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This special Radio Battery has all the Willard Threaded Rubber Battery features that are applicable to Radio work —plus many new ones found only in this battery.



## Bring Your Set Up-to-Date with this All-Rubber Radio Battery

It's just as important in receiving, to have a good battery as to have a reliable and efficient set.

The Willard All-Rubber Radio Battery was designed and is being used especially for radio work. It gives you the same reliability in wireless work as the starting and lighting battery has always given in motor cars. These batteries are available at a considerable less cost than the motor car battery.

Willard Radio Batteries are made with the same care and have the same Threaded Rubber Insulation as the larger batteries.

An important Radio feature is the All-Rubber Case. Cells and case are a solid piece of rubber that absolutely prevents leakage from cell to cell or to the ground, thus doing away with one of the most troublesome sources of noise.

Threaded Rubber Insulation and case are both tested with 24,000 volt wireless transformers before assembly. Freedom from leakage is thus assured.

For details about the Radio Battery, go to the nearest Willard Battery Station, or write us direct.

**WILLARD STORAGE BATTERY CO., Cleveland, Ohio**

*Made in Canada by the*

Willard Storage Battery Company of Canada, Limited, Toronto, Ontario

**Willard** **THREADED  
RUBBER  
BATTERY**

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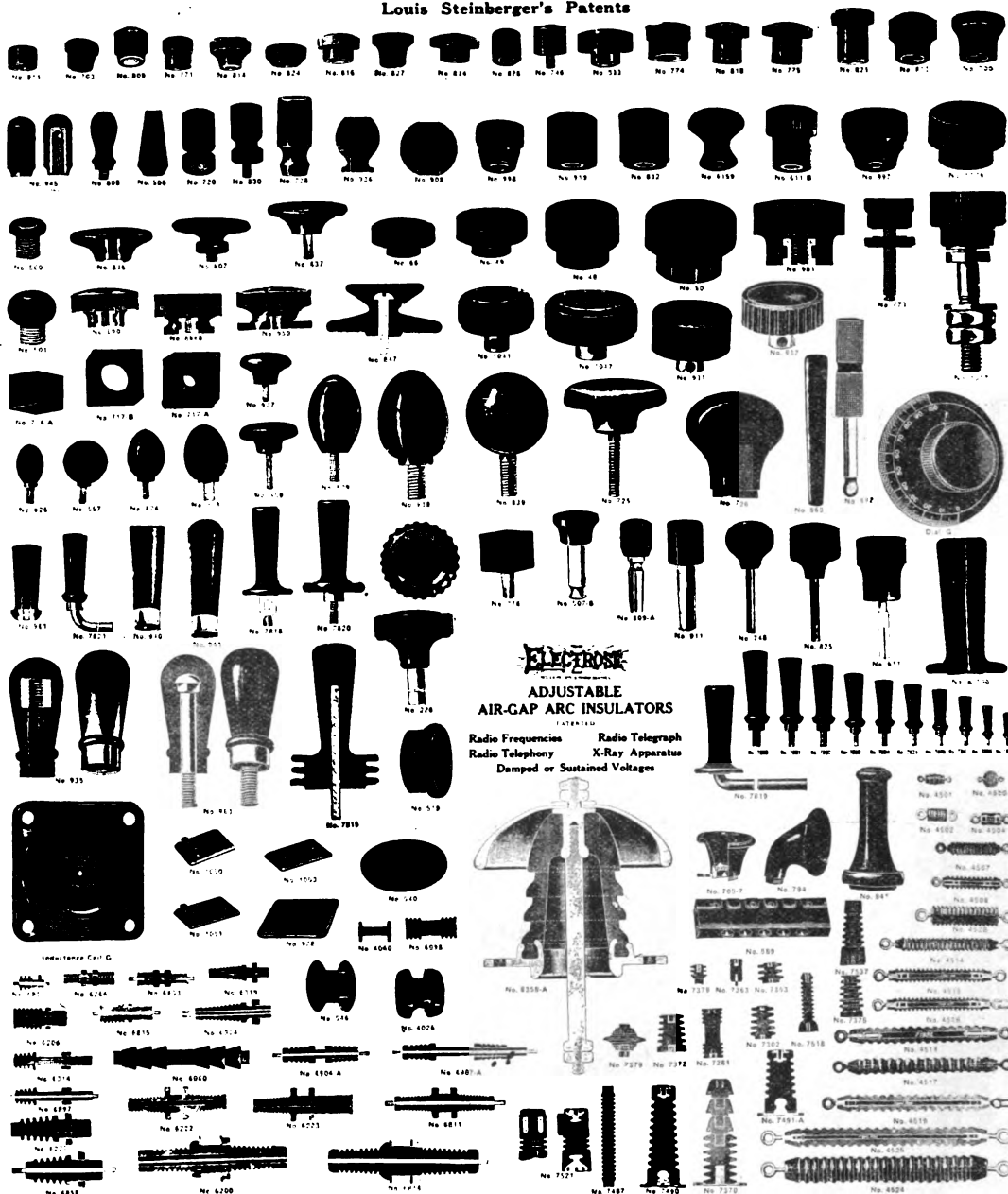
Medal and  
Diploma  
received at  
World's  
Columbian  
Exposition,  
Chicago, 1893



TRADE  
**ELECTROSE**  
MARK  
REG. U.S. PAT. OFF. & FOREIGN COUNTRIES  
**INSULATION**  
**MADE IN AMERICA**  
Louis Steinberger's Patents

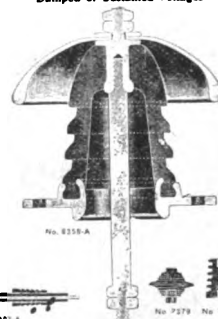


Medal and  
Diploma  
received at  
World's  
Fair,  
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1904



**ELECTROSE**  
ADJUSTABLE  
AIR-GAP ARC INSULATORS

Radio Frequencies Radio Telegraph  
Radio Telephony X-Ray Apparatus  
Damped or Sustained Voltages



"ELECTROSE" is made in a number of grades for various requirements, each grade possessing special characteristics.

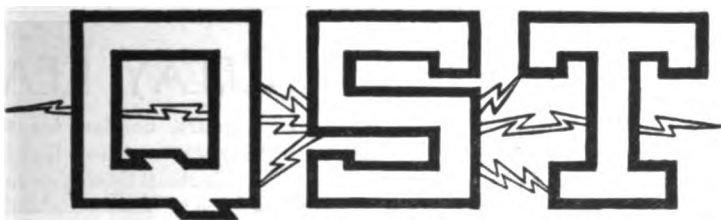
Insulators and insulating parts and devices of special sizes and forms, designed and made to order.

SOLE MANUFACTURERS

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60-82 Washington St. 27-37 York St.  
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**Brooklyn, N. Y., America**

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# The Official Organ of the A.R.R.L.

VOLUME V.

APRIL, 1922

No. 9

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Edwin C. Adams, Advertising Manager.

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THE AMERICAN RADIO RELAY LEAGUE, Inc.

HARTFORD, CONN.

# THE AMERICAN RADIO RELAY LEAGUE

"A national non-commercial organization of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave Radio Communication."

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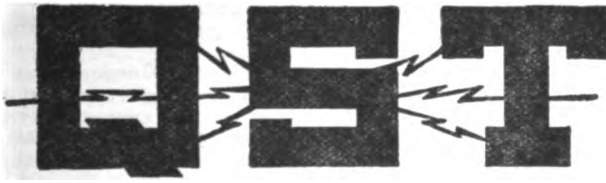
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**A Magazine Devoted Exclusively to the Radio Amateur**

## ***The Washington Radio Conference***

***By K. B. Warner***

**A**MATEUR radio has been recognized and honored in the first eight-day session of Secretary Hoover's Radio Commission. The Commission has recommended that a wave length band from 150 meters to 275 meters be allocated to amateurs and that this be specified in the new radio law; that this band be subdivided by the Secretary for the various classes of amateur transmitters, sparks on the shortest waves, then modulated C.W. (including self-rectifying C.W.), next radio telephones (including amateur broadcasts), and with straight C.W. telegraphy on the longest waves up to 275; and it has also recommended that amateur deputy inspectors be created whereby the amateur world may police itself and maintain observance of the subdivisions within the amateur band.

These are recommendations—they are not yet in effect. At this writing the Commission is in recess while a Legal Committee, of which Representative W. H. White, Jr., of Maine, is chairman, prepares a draft of an amendment to the present radio law which will make possible the changes in the regulation of all classes of stations, and it will meet again soon to study the new bill and give consideration to the comments received on its recommendations to date.

It was of course our good old A.R.R.L. which again represented amateur radio at Washington. Representatives of quite a few affiliated clubs were on hand to help, and they too of course are A.R.R.L. We wouldn't be surprised to hear about other folks who "saved the day for amateur radio" (after every scrap we do), but we're here to tell you that the A.R.R.L. was the only one on the job.

### **The Need**

As everyone knows who knows anything

at all about radio, there have been dozens of attempts in recent years to revise the radio law of 1912, which is more or less outgrown technically and does not give the government sufficient regulatory powers to adequately take care of the greatly changed conditions obtaining in radio today. The past efforts looking towards new legislation have with one exception all been dismal failures because they did not make adequate provision for all of the classes of stations. The one exception was the Department of Commerce Radio Conference Committee of 1920, which examined the so-called EU-F-GB-I Protocol and finally drew up wave length allocations which were agreed to by every American radio interest and transmitted to the United States delegates to the Paris Technical Conference of last summer; at which latter meeting, however, the military interests dominated and a tentative international agreement was drawn up greatly at variance with the U. S. recommendations and promptly repudiated and discredited by all the civilian radio interests here when the Department of Commerce reported the results in November last. So that attempt, too, came to naught.

In recent months the radio game has progressed to a point where it simply cannot wait any longer for new regulations. The advent of broadcasting is the chief contributing factor. There are now well over a half-million receiving stations in the country, some sixty broadcasting stations, and rumor has it that there are some five hundred applications for broadcasting pending in the Department of Commerce. Obviously some discretion—some real horse-sense—must be used in issuing licenses of this type or conditions in the air will be entirely chaotic. Recently everyone has been talking about the efforts of the big corporations practically to control the air

for themselves, with the American Telephone & Telegraph Co., we understand, making an outright request for a monopoly on broadcasting! President Harding and most of his cabinet members have receiving sets now, and so have many congressmen and senators, and they are aware of these conditions. What was to be done about the situation? It was apparent that the law would have to be strengthened to give the Department of Commerce wide discretionary powers, with the authority to issue, amend or revoke regulations and licenses according to the trend of the art, endeavoring at all times to regulate radio so as to be of the greatest good to the greatest number of our people. And it was apparent that everybody could not be wholly satisfied simply because there aren't enough wave lengths, and that consideration would have to be given the importance of the different classes of stations and a study made of the possibilities offered by the available wave lengths. For this purpose the Secretary of Commerce was instructed to call a conference of radio experts to make a study of the situation and recommend principles to him for the governing of all of radio for the greatest good to the greatest number, keeping in mind the importance of the various services. He appointed to his committee Mr. H. P. Maxim, president of our American Radio Relay League; Dr. S. W. Stratton, director of the Bureau of Standards; Senator Frank B. Kellogg of Minnesota; Representative W. H. White, Jr., of Maine; Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers; Prof. L. A. Hazeltine, of Stevens Institute of Technology, Hoboken; Prof. C. M. Jansky, Jr., of the University of Minnesota; Mr. R. B. Howell, of Omaha, Neb.; Mr. E. H. Armstrong, of Columbia University; and one representative each from the War Department, Navy, Post Office, and Agriculture, who were, respectively, Major General Geo. O. Squier, Capt. S. W. Bryant, Mr. J. C. Edgerton, and Mr. W. A. Wheeler.

When this commission met in Washington on February 28th it was the most important radio body which had ever sat. We have every reason to hope that at last, after years of vain struggling, the radio situation is to be improved.

The first two days of the conference were given over to public hearings, at which representatives from all of the radio interests were present and given an opportunity to be heard. Then the Commission went into executive session, to formulate a plan by which the Secretary of Commerce can wisely administer radio regulation to the whole country, and to formulate a draft either of a new law or of an amendment to the 1912 law. Three committees were appointed, known as the Legal, the Technical and the Amateur Com-

mittee. Of the last-named, Mr. Maxim was chairman, with Mr. Armstrong and Professors Jansky and Hazeltine as members.

#### The Corporations Testify

The hearings were funny. First to be heard were representatives from the five big corporations whose association has caused the buzz of comment on the monopolistic conditions in the art. There was Mr. A. H. Griswold, vice-president of the A. T. & T. Co.; Mr. E. P. Edwards, of the General Electric; Mr. John Elwell, secretary of the Radio Corporation; Mr. L. R. Krumm, representing Westinghouse; and Dr. Nichols, of the Western Electric. In turn these gentlemen explained the attitude and the relations of their respective companies, told what they would like to have in new law, and made their recommendations for the general improvement of conditions. Now it seems that there is quite a bit of feeling in the air these days to the effect that the corporations are trying to hog things; that they have in effect a monopoly; that for that reason they won't sell equipment to competitors; that they could supply equipment a whole lot faster if they really wanted to; that they ought to be hung higher than Haman for the type of receiving apparatus they are putting out. In turn the gentlemen denied these charges, but they were so busy answering questions relative to these matters and the air was so charged with feeling along this line that the hearings rather took on the aspect of a Congressional Board of Inquiry!

Mr. Griswold testified that the A. T. & T.'s only interest in broadcasting was to sell toll broadcasting service. In response to inquiries he stated that his company would sell transmitting equipment for broadcasting in connection with the purchaser's own business or for public service broadcasts. He explained the patent situation by describing the agreement made between A. T. & T. and G. E. at the request and approval of the government, for the merger of patent rights, the A. T. & T. retaining all commercial applications of the radiophone, the General Electric the amateur radiophone business and all classes of radio telegraphy. Radio Corporation and Western Electric entered later as an extension—it was agreed that G. E. might extend any of its rights to the Radiocorp and that the A. T. & T. might extend any of its to W. E. Still later, Westinghouse made an agreement with General Electric and entered in, Mr. Griswold said, A. T. & T. consenting.

Mr. Edwards thought that commercial broadcasts ought to be confined to daylight, with only entertainment in the evenings. In general, he favored control of broadcasting by big corporations and the government, and rather thought jazz should have

precedence over crop and market information, suggesting that the latter, for economy's sake, should be put out by entertainment broadcasting stations. Answering inquiries, he stated that Westinghouse and General Electric manufacture equipment under licenses from Radio Corporation, which is cross-licensed in turn. Radiocorp is the only one who can buy Westinghouse and G. E. apparatus, and must sell those makes only. He volunteered the information that General Electric were themselves manufacturing receiving apparatus and would have a line of complete sets on the market very soon, which he thought were of the single-circuit type. He stated that by the latter half of March their tube production would be between fifty and sixty thousand per month; that they manufacture tubes only on order from the Radio Corporation but that they are now being made at three times their former rate.

Mr. Elwell, secretary of the Radio Corporation, made a good clean-cut statement, suggesting that stations be classed in the order of their importance as follows: government, civil departments, maritime, educational, entertainment, amateur, public service. He thought legislation should safeguard life at sea and the future of the amateur. He put his company clearly on record as favoring the recognition and encouragement of the amateur. He asked permission to file a statement for the benefit of the commission, explaining the patent situation, the relations between the companies with which his was associated; the policies in the sale of apparatus, etc. The testimony of his company on these subjects accordingly was never public property. Unfortunately Mr. Elwell could answer practically no questions, particularly along this line, and in every case stated that the answer to said questions would be contained in the statement he wished to file.

Mr. Krumm, assistant sales manager of Westinghouse and in charge of their broadcasting stations, objected to the interference that anybody's five-hundred dollar limited commercial broadcasting station could cause to Westinghouse's \$15,000-stations. He thought twelve to fifteen broadcasting stations would be enough for the country, and proposed the band from 300 to 400 meters for them.

Dr. Nichols of course is a scientist, and knew his subject technically, in marked contrast to the other gentlemen. Testifying for Western Electric, Dr. Nichols thought fifteen good broadcasting stations enough for the country, and thought they logically ought to be on shorter waves because of the greater "cyclage" there. On the other hand, he thought the more important subject was ship-to-shore radiotelephony, and as several bands were desirable for that and there was objection to it being raised to a point over 1000

meters, he thought the broadcasts could very well be raised instead.

Mr. Cooper, of the Ship Owners Radio Service, proposed subdivision of amateur services over a band from 200 to 350 meters and a similar sub-division of commercial phones, advertising broadcasts on 400 meters, general entertainment broadcasting, etc., 1500 to 1700; and commercial telephony from 900 to 1200. Hurray for Sorsinc.

Mr. Max Loewenthal, of San Francisco, representing the Pacific Radio Trade Assn., told the committee of the schedule of time divisions satisfactorily employed on the West Coast, and that they there would welcome government regulation.

### Amateurs Are Heard

Thus ended the first day. On the second morning amateur representatives were heard. They were represented by an A.R. R.L. delegation composed of Paul F. Godley, Vice-President Chas. H. Stewart, and Secretary K. B. Warner. Again that paragon of radio amateurs, Paul Godley, rendered a valuable service to the game—he very splendidly presented the case of the amateurs: their need for a band of waves versus a fixed limiting wave length; the desirability of subdividing the band for the different classes of stations; the need for grading amateur operators into two classes, with beginners on a different wave length, etc. He pointed out the fact that most of the trouble broadcast listeners have been experiencing thru interference has been due to the wretchedly broad-tuning receivers that have been supplied them in the belief that they are incapable of mastering a modern tuner, and in particular called the attention of the Secretary to the publicity that in recent months has appeared in the press characterizing the amateur repeatedly as "the American small boy" and saying that he must be curbed because he was interfering with everything, etc. This publicity has been so consistent, so much along the same line wherever it appeared, that in the minds of many amateurs it is considered as inspired propaganda from unfriendly interests. Some of these newspaper items have attempted to put the Secretary in the position of saying that the amateurs must be curtailed, but we want to tell the world that Mr. Hoover has spoiled all that stuff for all time henceforth. Here is his reply:

*"I would like to say at once that anyone starting any such suggestion that this conference proposes or had any notion of limiting the area of amateur work was simply fabricating. There has never been any suggestion of the kind, never any discussion of the subject in any shape or form. The amateurs were asked to be represented in the conference and they are represented here today, and the starting*

*of that sort of information is one of the most treacherous things that can be done. So I wish to sit on that right at the start—that the whole sense of this conference has been to protect and encourage the amateur in every possible direction."*

Newspaper propaganda to the effect that the amateur—"the American small boy"—is an infernal nuisance and must be "curbed" has been noticeable by its absence since the Secretary's statement. Flock o' Hi's!

A.R.R.L. Secretary Warner followed Mr. Godley in the witness chair and was also heard in the interests of the amateurs. In common with the rest of the amateur delegates he particularly urged that the commercial broadcasts be placed on a band above 1000 meters, where interference from ships and the occasional conflicts with local amateurs that will be practically unavoidable as long as novice listeners use single-circuit tuners would be minimized, pointing out that the present broadcast wave of 360 meters could only be regarded as an invasion of what has always been regarded as the amateur realm—up to 375 meters. Vice-President Stewart followed, supporting the same views, recommending 325 to 425 meters for ship-to-shore telephony, and showing from a study of the current International Convention that there is nothing to prevent the United States from placing the commercial broadcasts on a higher band, say above 1000 meters.

Representing independent commercial companies were Mr. Perry E. Wiggin of the Radio Electric Co., Pittsburgh; Mr. L. F. C. Horle, of the Federal Tel. & Tel. Co., Buffalo; Mr. Thompson of the DeForest company; Mr. H. J. Breckel of the Precision Equipment Co., Cincinnati, etc. All of these men had a good word to say for the amateurs, particularly Mr. Wiggin, who of course is our A.R.R.L. City Manager for Pittsburgh and also represented the Radio Engineering Society (affiliated) of that city.

Then came representatives of various interests who were concerned with radio-telephony—The New York Public Service Corporation, the Philadelphia Police Department; the "Detroit News", the National Retail Dry Goods Assn., the U. S. Shipping Board, the Boy Scouts, the Public Health Service, etc., each presenting his side of the story. Several sharp skirmishes took place between conflicting interests, generally with the oft-referred-to corporate interests on one side of the fence. It was good in spots. Regardless of the truth of the statements or the possibility of proving them, almost everybody except the representatives of the several big companies seemed to feel that a monopoly of radio did exist, far beyond that contemplated by the separate patents granted them; that they were earnestly endeavoring to hog the whole

air and deliberately fostering discontent where it helped their interests; selling apparatus only where they wanted to and holding down their competitors even when they couldn't make apparatus fast enough to supply the public need in a field that must be regarded as a public utility, etc. They got raked over the coals in high fashion and spent considerable of their time on the defensive, which it was obvious they had not contemplated when they arrived at the conference. Good judgment prevailed in the Commission, however, and the big companies should be well satisfied with the provisions recommended from their uses.

### The Commission's Recommendations

Finally the hearings were over and the Commission went into executive session. It was the Editor's good fortune to be permitted to attend the meetings as advisor to Mr. Maxim and he only wishes that it were permissible to tell the gang all the interesting talk that went on, but the deliberations of course were confidential. The big plan is that an amendment is to be proposed to the 1912 law, giving the Department of Commerce wide discretionary powers in classifying stations and assigning wave lengths, powers, operating hours, etc., for each of the various classes. The principal duty of the Commission was to outline guiding principles for the administration of radio for the greatest good to the greatest number—in other words, to recommend to the Department what it should do when it received the wider authority now universally recognized as essential to it.

First off, the Commission divided broadcasting into four classes, as follows:

Government—meaning material of national interest, to be broadcasted from government stations of about 600 mile range. Public—meaning material of general public interest (informational and educational services) such as market and crop reports, weather forecasts, health services, etc., as might be broadcasted from University stations, etc., normal range to be 250 miles.

Private—meaning the broadcasting of entertainments, news, etc., by the owners of such stations as the Westinghouse ones, etc. This is the big popular class. Normal range, 50 miles.

Toll—meaning transmissions from such stations as contemplated by A. T. & T. at present, which will be leased for the broadcasting of entertainment, news, etc., under toll. Range, 50 miles.

The recommendations of the Commission have now been made public by the Department of Commerce. They make the following proposals for the disposition of various wave lengths:

Below 150 meters—reserved.

150 to 275 meters—Amateurs.  
 200 to 275 meters—Technical and training schools.  
 275 to 280 meters—City and State public safety broadcasting.  
 310 meters—Restricted special amateur telegraphy.  
 310 to 435 meters—Private and toll broadcasting.  
 500 to 525 meters—Aircraft radio.  
 525 to 650 meters—Mobile radio telegraphy.  
 650 to 750 meters—Mobile radio telephony.  
 700 to 750 meters—Government and public broadcasting, 700 miles inland.  
 750 to 850 meters—Radio compass.  
 850 to 950 meters—Aircraft radio.  
 950 to 1050 meters—Radio beacons.  
 1050 to 1500 meters—Government and public broadcasting.  
 1500 to 1550 meters—Aircraft radio.  
 1550 to 1650 meters—Fixed station telephony.  
 1850 to 2050 meters—Government broadcasting.  
 2500 to 2650 meters—Mobile radio telephony.  
 2850 to 3300 meters—Fixed station telephony.  
 5000 to 6000 meters—Transoceanic telephony.

#### Amateur Provisions

The following recommendations of the Commission relate directly to the amateur proposition and are of the highest interest to us amateurs:

"That the status of the amateur be established by law.

"That the limits of the wave length band allocated to the amateur be specified in the law.

"That the wave length band allocated to the amateur be from 150 to 275 meters.

"That the Secretary of Commerce subdivide the amateur allocation into smaller wave length bands for the various classes of amateur transmitting apparatus, at his discretion but in the following order of wave lengths, starting at the shortest wave: spark, interrupted or modulated continuous wave telegraphy, telephony, continuous wave telegraphy.

"That for the purposes of self-policing among the amateurs, amateur Deputy Radio Inspectors be created, elected from their number by the amateurs of each locality, every licensed amateur having the right to vote; that upon receipt of notice of such election the Radio Inspector in charge of the district in which such amateurs are located shall appoint the person chosen a Deputy Radio Inspector, serving without compensation or for the sum of one dollar per year if compensation is legally required; that the duty of such Amateur Deputy Inspector shall be to en-

deavor to the best of his ability to accomplish, under the direction of the District Radio Inspector, the observance by amateurs of the Radio Communication Laws and Regulations of the United States and the observance of such local co-operative measures as are agreed to in each community for the minimization of interference between the various groups of the public interested in radio; that such Amateur Deputy Radio Inspectors be clothed with whatever authority may be necessary in the opinion of the District Radio Inspector."

The Commission urged that the present regulations governing experimental stations remain in effect, and regarding amateur broadcasting it was recommended that amateurs be permitted to carry on broadcasting within the wave length band assigned by the Secretary of Commerce to amateur radiotelephony. Plainfield, (N. J.) papers please copy!

The special restricted amateur wave of 310 meters is for use by a limited number of inland stations and only where it is necessary to bridge large, sparsely-populated areas or to overcome natural barriers.

There was considerable talk at the hearings about the abolition of the amateur spark. While QST has consistently boosted C.W. in the knowledge that it was the real stuff, it subscribes heartily to the sentiment expressed by all the amateur representatives at the hearings, which views were shared by many others; namely, that the prices on C.W. apparatus, particularly tubes, are entirely too high at this time to justify any such thing as a law forbidding spark, which would require that every station owner purchase tubes and other apparatus from the one combination of companies controlling all the patents, especially when the patent-holders cannot supply the demand nor do they license other companies to manufacture these products. Everyone seemed willing to admit, however, that when good C.W. apparatus and tubes became widely available at decent prices, the amateurs would be willing to forsake the spark upon reasonable notice. Thus we find the Commission recommending "that the Secretary of Commerce at his discretion prohibit at any time the use of existing radio transmitting apparatus and methods which result in unnecessary interference, provided that such action should not be taken unless more satisfactory apparatus and methods are commercially available at reasonable prices and until an adequate time interval is allowed for the substitution of the more satisfactory apparatus."

The Commission likewise gave much attention to the radiating proclivities of autodyne receivers, particularly of the single-circuit type where the oscillating antenna

current may be quite appreciable, and adopted a recommendation very similar to the above paragraph respecting spark and arc apparatus only this time applied to the use of existing radio receivers which cause the radiation of energy.

### Broadcasts Not Raised

The Commission was unable to see the practicability of putting the last two classes of broadcasts on a higher wave, say above 1000 meters, as seems so very desirable; not out of consideration for the short-wave receiving apparatus now in existence but from a purely technical con-

sideration. A radio telephone requires a band of cycles, as everyone knows. Possibly 10,000 cycles is a fair estimate of what is required for a decent phone. This puts it strictly on a basis of "cyclage", and the more the cycles the more phones that can be operated in a given band of wave lengths. Thus there is room for less than a dozen phone waves in the whole band from 1050 to 1500 meters, whereas something over two dozen can be accommodated in the much small wave-length band from 310 to 435 meters. Up to this writing, then, we have failed in our desire to get the broadcasting raised to a higher wave, and it seems likely that we will continue to have it as a next-door neighbor. This means that we amateurs have an educational job on our hands, and it is going to be up to us to convince our listening-in neighbors that there are lots of other sources of interference than our transmission.

The Commission has recommended that the status of the amateur be specified in the law, that is, that he be named as one of the classes of stations which shall always be established by the administration, and that the amateur wave length allocation, 150 to 275 meters, be specified in the law. This we regard as essential—for a thousand reasons. We have to thank our present guarantee in the 1912 law for our present existence—several times we would have gone up the flue if it hadn't been impossible to abolish us without changing the law, which is always a hard matter. With waves reserved below us, and the broadcasts clamoring above us, big combinations lobbying at Washington for more

cycles and our existence based purely on temporary classification of the Department of Commerce, subject to fluctuation by official proclamation, we'd be in a sweet pickle. The fact that the biggest broadcasting field is to continue right above our heads where some conflicts with the novice public are unavoidable, with their consequent unpleasantness and embarrassment and complaints to the government, etc., is the big reason why we amateurs must all insist that we get our guarantee of continued existence written right into the law as it is at present. The present Secretary of Commerce and our good Chief Radio

Inspector, Mr. Terrell, are splendid friends of the amateurs, but some day somebody else may be in their respective offices and the amateur future might be worth about two cents. Altho contrary to the plan of the proposed amendment which would leave the specification of classes and wave lengths subject to change at the discretion of the Department, we feel that an exception can be made with propriety in the case of the amateur because his wave

length band is at one end of the spectrum and his province can be defined and all other frequencies left subject to change without disturbing the operation of the scheme. This has an added advantage in stabilizing the use of the frequencies near us, for what company would want to put their millions into equipment that might be made junk of by sudden shift in the amateur wave?

*We must have our status written into the new law.* Remember that, A.R.R.L. men, whenever you see a copy of a new radio bill, and be governed accordingly

The proposed allocation of 150 to 275 meters to us amateurs, sub-divided among our various classes of transmitters, will make a wonderful improvement in our operating conditions, where we already have some 15,000 transmitting stations; and with government approval of our A.R.R.L. scheme for self-policing, we can look forward to sunny prospects in the amateur world.

### President-Governors' Relay Succeeds

**I**N spite of terrific atmospherics over almost the entire country on the first two nights of the tests and widespread unfavorable conditions on the last night, the President-Governors' Relay was a success and a total of forty out of forty-eight messages were delivered to the White House.

A couple of the messages seem to have been unable to get out of their home state, and a few of the Democratic governors couldn't see the joke and declined to furnish a message to the Big Chief.

A complete story of the Relay, with texts of the various messages and dope on who handled them, will appear in the next QST.

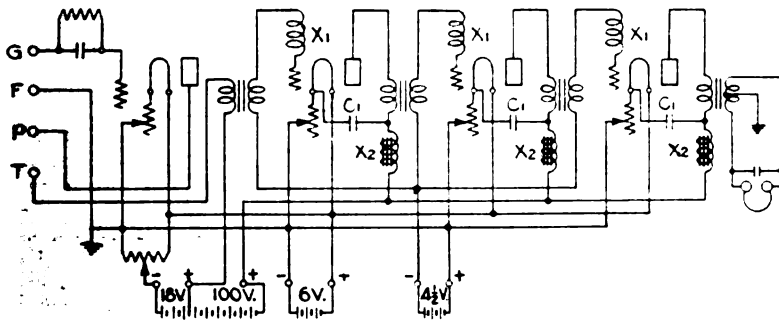
# Improvements In Multi-stage Audio Amplifiers\*

By H. E. Bussey, 4AI

It is not the purpose of this paper to claim any discoveries, or to take to the author any credit for the results secured by the application of the measures which will be described—probably some of them are known to you. I am indebted to various Engineers in the Research and Radio Departments of the General Electric Company for the suggestions which have vastly improved the operation of the audio amplifier in my case.

Local noises and lack of expected amplification per stage have not, prior to the advent of so much telephone reception, been as objectionable as it is at present. If we may improve the amplifier so that the same results can be accomplished with fewer stages, then we have gained a decided advantage in both economy and ease of operation.

In order to prevent interaction between stages, it is proposed that thorough shielding be used for both magnetic and static effects, and to completely enclose each stage as well as the detector on all sides, top and bottom, with a 1-16 inch sheet steel shield. An amplifier was built unshielded with provision so that shields could be applied to see what, if any, difference could be noted. Without the shields in place, two stages could be operated, but with far less amplification than should be expected. Three stages were not possible due to howl and other noises. Shields as described were put in place, the inter stage wiring being carried through slots in the inter stage shields, and the improvement was remarkable. The shields and transformer cores were connected to the positive end of the B battery. The shielding was certainly a step



The ideal amplifier is one which in each stage takes the signal from the preceding detector or stage, and without reacting in any way on the preceding stage, repeats what is delivered to it and amplifies it as much as possible without distortion before delivering the signal to the next stage. Troubles are experienced in attempting to do this from electromagnetic and electrostatic reaction of one stage on another, if measures are not taken to prevent it. Added to the reaction between stages local oscillations may start within a stage and tend to upset the amplification constants of the tube. These oscillations may apparently be of very high frequency, and if so, may not be audible, or may be of the audible frequencies and result in the well known howl so familiar to all of us.

in the right direction, but all interaction was not eliminated even by this means, as a certain amount of coupling back still existed through the common plate battery. In order to overcome this an iron core choke,  $X_2$ , was inserted in the plate lead of each stage and a 1 mfd. condenser,  $C_1$ , inserted as shown in the diagram. The improvement at this point was very great—three stages working much quieter than two had before and signal audibility per stage very nearly doubled. The quality of telephone speech also seemed much clearer. The iron core chokes consist of the 110 volt winding of a standard bell ringing transformer. This choke as well as the condenser is installed inside the shielded case of the stage to which it belongs.

The complete shielding of the transformers alone was tried first, but that did not seem to effect noticeable improvement. The

\*Read before Third and Fourth District Convention, February 17, 1922.

filament rheostats, tube sockets, wiring, etc., all seem to be a source of troublesome coupling back.

A further refinement has been added to lessen the possibilities of the tubes oscillating at very high frequencies as previously mentioned, in the form of radio frequency chokes,  $X_1$ , consisting of 25 turns of No. 30 D C C wire wound in a single layer on a wooden form 1 in. in diameter. These are inserted on the tube socket and connected in the grid lead of each tube.

In audio amplifiers of several stages the miscellaneous popping and grinding noises sometimes present are from a variety of causes, but the majority of them are eliminated by the foregoing measures. Some of the more common ones not eliminated are bad contacts at any point. All joints in wiring should be soldered securely. Dry cells run down are unsuited for use in plate circuits. Several good dry batteries are now on the market designed for a minimum of such disturbances. Poor contacts in fila-

ment circuits, such as poorly designed rheostats and storage cells in bad condition, also cause noises. Much has been said of the necessity of good B batteries, but of equal importance are the filament battery and filament connections, as some of the most objectionable noises come from this source.

Loose contacts in tubes and tube sockets, and poorly made grid leaks should also come in for inspection and elimination.

For those who wish still further refinement, the use of an output transformer is recommended. This transformer permits the use of any ratio of tube impedance to phone impedance desired, by change in transformer design and permits the use of more rugged low resistance phones than when used directly in the plate output circuit. An added advantage is that the center point of the transformer secondary may be grounded and minimize the objectionable coupling back from the operator wearing phones, to the tuning element.

## ***“And It Came To Pass”***

### ***The Episode of the Much-Married Ham and the Radio Widow***

**By S. P. W.**

**A**ND it came to pass that a certain dial-twirler reached the age when shaving becometh a nuisance and not a novelty, and the latest dance step arouseth more interest than Einstein's theory of relativity, and as is the habit with young men, he falleth in love. And lo, as time passeth, he confuseth osculations with oscillations, and spooning with tuning, and his sparks no more roareth thru the ether, or whatever the latest theory contendeth that sparks roar thru. Yea, he disappeareth from the list of “Calls Heard,” and his friends wonder.

In the fullness of time he asketh HER the fatal question, and she accepteth him. The final Hook-up is consummated, even as it is ordained, and the couple go forth on their honeymoon and they shed rice and smiles as they go, for such is the custom.

But on the nineteenth day thereafter, they return to the home town, and take up their residence in Bungalow Row. And lo, no sooner do they return than he erecteth a pole in the back-yard, and fixeth a staff to the ridge-pole. And in the course of time an aerial swingeth; lo, it is complete even unto a lead-in and ground.

And his wife asketh him wherefor, saying “Why stringest thou those wires?”

“Why clutterest thou up the attic with junk?”

“Why poundest thou so on divers con-

traptions, whereof I know not the name?”

“Why bringest thou thy friends to track thru my perfectly clean house?”

“Why——” But list to thine own wife when thou takest one unto thyself, for each inquireth the same.

He trieth valiantly to explain the mysteries of radio; he persuadeth her to enter into the operating room. But she crieth out when the spark crasheth in the gap; she claimeth that the cans hurt her ears, that the head-band pulleth her hair, and other heresies. She complaineth that the buzzing of the sparks giveth her headache; she seeth no good in radio, and departeth downstairs. And it was so for years, even to the number of the fingers on one hand.

\* \* \* \* \*

The war cometh and goeth, and the aerial and set goeth and cometh back, as was ordained in Washington. And with the return of the set cometh strife. Our hero's wife setteth down her foot; she saith all manner of harsh things against radio. She beggeth and pleadeth, she threateneth to return to the domicile of her maternal parent; she doeth all manner of things to prevent the return of radio in her household.

She saieth unto him, “My lord, I wish not to be even as the wives of the golf bugs, and to be called a ‘radio widow,’ for radio taketh up thy evenings, and maketh



thee to neglect thy wife. Thou speakest of regenerators in thy sleep, yea, thou mutterest and groanest and cursest QRM. Thou comest to bed in the small hours, and wakest me to rave of DX. Of my past experience do I know that thou makest of radio a nuisance and an abomination; surely this thing shall not be!"

Yet the aerial did blossom forth again, and the old set cometh to light. And in the course of time, a new set assembleth itself, and five-watt tubes glow where the spark was wont to crash, for wherefore can a set be modern, and yet use a spark? His wife sulketh and gnasheth her teeth, and extracteth much largess in the form of flowers, sweets and knick-knacks ere she cheereth up.

But the set endureth; it was, and is, and always shall be, for when the bug biteth, he biteth deep; the virus pulseth to the far parts of the body and sinketh in; even matrimony faileth to eliminate it.

Time passeth, even as it is wont to do, and lo, it worketh wonders; a miracle is wrought in the household of our friends. For Ye Editor insisteth upon a happy ending, and how can anything be happy when thy wife hateth thy hobby, and stirreth up strife accordingly? Yea, a miracle is needed, and behold, it is chronicled in this wise.



The time cometh when the phones fill the air with sweet noises (provided only that their modulation be good!) and our hero thinketh unto himself "My storm and strife loveth music, else why runneth she me in debt for a Victrola, and why carteth she home numerous records therefor?"

And he reasoneth further "An it be she loveth music, why loveth she not radio? For it has come to pass, even as the singer of old hath predicted, that 'our nights shall be filled with music, and the cares that infest the day shall collapse like a trick loose-coupler, and silently fade (we'll say they "fade"—ED.) away,' or words to that effect." And he pondereth much on the matter, till he decideth upon a plan.

The next night he bringeth home the

Magnavox that belongeth to the Club, and he borroweth two extra stages of amplification. He departeth immediately from the dinner table, and ascendeth to the radio shack. He hooketh up his instruments cunningly, he lighteth his tubes even unto the fourth step. He testeth exceedingly, and looketh frequently upon his watch until it be the time for KDKA to start.

Then he switcheth in the Magnavox and openeth all the doors. He tuneth for the carrier wave, and findeth it. The shriek soundeth throughout the house, being amplified exceedingly, and he heareth with falling heart the reproaches of his wife. At last soundeth the voice of the operator, as he announceth a selection by an orchestra of much note, (wherein no pun is intended) and our hero chuckleth unto himself, and brighteneth up his tubes.

And lo, in a second the sweet sounds of the orchestra burst forth most powerfully, and the lilting strains fill the house. It is good radio weather, and the static QR Neth not. Our hero sinketh back in his decrepit armchair, and thinketh good thots of everything and everybody saving three "5" stations that QRM on 360 meters.

And it came to pass, even as he had planned, that his wife rusheth to the radio room, and registereth joy and amazement. She listeneth with rapture to the smooth voice of KDKA announcing a tenor solo, and closeth her eyes dreamily at the love song she heareth.

And then she bombardeth her husband with questions, saying, "Why hast thou not told me of this wonder? How cometh it that we hear sweet sounds, when we used to hear only trick buzzes? Whence cometh this music?" and divers other things.

He answereth her with dignity, saying "In the past hast thou spoken all manner of evil things falsely against radio, so I gathered that thou wouldst not be interested!" And he assumeth an expression of wounded pride, and registereth indifference.

But she, being wise in the ways of men, as are all women, saith unto him sweetly, "How marvelous of thee, my lord, to operate these instruments! How wise art thou to master all this junk! My man art thou, and truly, I am proud of thee!"

And he acteth, even as would thou and I, like unto the small boy praised in front of the class by the teacher, and he saith, "Aw, it is a simple matter! Thou tunest with this dial, and regeneratest with this" and he suiteth the action to the word, and showeth her much. He explaineth all things unto her, and teacheth her to operate proficiently. Her sensitive woman's fingers learn easily the accurate adjustments, she comprehendeth the functions of the rheostats and learneth even to forget not to throw the lightning switch.

And it came to pass that night that the

Radiofonus Fanerii, a bug of the genus Radio, did bite the wife of our hero, and she exhibiteth the usual symptoms. She studieth catalogs and catalogs and diggeth into old radio magazines. She maketh salad



dressings with transformer oil, and baketh pieces of wire and calleth it macaroni au Marconi. She cutteth doughnuts on a spiral and frieth them into O.T.'s. She substituteth a call book for the cook book, and taketh out a membership in the A.R.R.L. She joineth the Radio Club and delighteth in the title of "OW." She learneth the Code, and becometh a regular ham; her

husband exulteth exceedingly, and saith unto himself "This is my work!" and he is much puffed up.

\* \* \* \* \*

For his birthday she giveth him two steps of amplification and for Christmas a Magnavox of his own, and evenings she sitteth on the arm of his chair and whistleth "D-o-y-o-u l-o-v-e m-e?" and he whistleth back; "dit-dit-dah, dah-dit dah-dah-dah, dit-dit dah!" and rejoiceth exceedingly. Which maketh the happy ending that Ye Editor hath insisted upon.

(As a matter of fact, our hero's wife told him just the other day that he shouldn't spend another cent for that darn-fool radio set till she got a new coat and a new hat that Lord knows she's needed for a year, and that she couldn't see why on earth a grown-up man wanted to monkey around with that sort of thing, and why didn't he—but there! You married hams will get me, and the single ones will never understand till they go thru it, so why continue with the harrowing details? You've had your happy ending, anyway!)

## Improving Antenna Efficiency

By M. B. West

Every time Mr. West writes an article he "starts something". Probably this is some more of the same. It is especially commended to the power-factor sharks of last season's discussion. This paper has been prepared with care and its arguments regarding power-factor are supported by Prof. J. H. Morecroft in his latest text-book. Personally we do not subscribe to all of it and it is unpleasant to have all of one's radiation theories completely upset, but the subject-matter below and the manner of its handling will start every one of us to thinking—and that means progress. With knowledge of what we are doing, then, and wishing it understood that we haven't decided whether to believe this or not, we prayerfully present Mr. West's latest.—Editor.

THE "riot," which was with so much difficulty just barely averted by the timely and vigorous use of the gavel by Chairman Mathews when the subject of "power factor" was brought up at the technical meeting at the Chicago Convention, demonstrated one thing to me very clearly. That was the seeming fact that no one really understood exactly what happened in a simple oscillation circuit, or, if any one really understood, no one seemed able to tell. And, if there was so much difference of opinion concerning the action of the one fundamental circuit on which all radio work is based, it must of necessity follow that much of our work was, relatively speaking, "in the dark," and the question was of more importance than really appeared at the time.

While it is not the purpose of this article to re-open the discussion on power factor, the question of what really happens in an oscillatory circuit is of such importance that an explanation will, of necessity, refer to the subject.

Fortunately, "Principles of Radio Com-

munication," 1921, by J. H. Morecroft, devotes considerable space to the subject, and, insofar as I am able, I will follow the explanation given by him without the mathematical formulae. We will first consider a simple oscillatory circuit, Fig. 1, which may be considered as the closed circuit of a spark transmitter, the gap being replaced by a switch. Assume that the condenser is charged to a given potential, which is shown as point (a) in Fig. 2. If the switch (S) is now closed, current will immediately begin to flow through the inductance (L) and resistance (R), and will be represented by the solid line in Fig. 2. While flowing, the current will build up a magnetic field in the inductance (L). Quoting Morecroft, "The maximum current occurs one quarter of a cycle after closing the switch, nearly." The effect of the resistance is to make the current greatest shortly before the quarter cycle is reached. "Now this could have been predicted from the consideration of energy in the circuit: before the switch is closed all the energy is in the condenser." "One quarter cycle after

closing the switch the voltage across the condenser is zero so all the energy must be in the coil." The current flowing through the coil has set up a magnetic field around the conductors and as this field collapses it generates an electromotive force in such direction as to maintain the current flow,

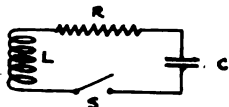


FIG 1

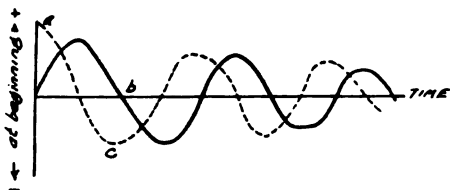


FIG. 2



FIG 3

and current continues, this time charging the condenser in the reverse direction until we have at one half cycle zero current again and again a potential across the condenser. In other words, the energy is back in the condenser again, with the difference that the plates that were charged positively at first are now charged negatively, and vice versa, and that some of the energy has been lost in heating the resistance. Thus we have the energy oscillating "back and forth between the coil and condenser and being wasted during the transfer." And, assuming a decrement of 0.3, this gives a "power

factor of  $\frac{3}{\pi} = .0955$ : the phase difference" of the current and potential "is therefore 84.5°."

We are told, however, that at resonance "the capacity reactance and inductance reactance are equal and opposite" and that the current "is limited only by the resistance." This is true and can be best explained by reference to Fig. 3. Here we have a simple oscillatory circuit, as in Fig. 1, with the switch closed, but with the inductance loosely coupled to a source of alternating current of the same frequency as that to which circuit (A) is tuned or is resonant. In this case the current in circuit (A) will be in phase with the potential or voltage in circuit (B). Insofar

as circuit (B) is concerned, circuit (A) has no reactance, and the power factor of circuit (B) is not affected by it. Insofar as the relation between the potential in (B) and the current in (A) is concerned, the power factor is unity. But the potential in (A), provided the resistance is negligible, is 90° out of phase with the current in (A), and the power factor is near zero. Remembering the telegram from the Bureau of Standards—"the current is in phase with the IMPRESSED potential"; in case of Fig. 1, the impressed potential has ceased to exist when oscillations occur, and in the case of an arc transmitter, the impressed potential is a direct current, so cannot have a phase relation. However, the principle is still true, for, in a free oscillating circuit, the current is in phase with the impressed potential, or would be if there was an impressed potential. However, when we consider the current in Fig. 1 in its relation to the potential in that circuit, its power factor can never become unity unless the resistance is of such value as to dissipate the power during the first quarter cycle, in which case the power factor would be unity and no oscillations at all would occur. On the other hand, the voltage in circuit (A), Fig. 3, bears only a very indirect relation to that in circuit (B). The voltage in (A) is the counter-electromotive force generated by the inductance in its own circuit. This, in turn, depends on the current in (A), [the current in (A) is limited only by the resistance in (A)] and the rapidity with which the current changes in intensity. It follows logically that if we decrease the resistance in (A), we will increase not only the current but also the potential. As we can never do away entirely with the resistance in (A), it follows also that if we use a small value of inductance and a large value of capacity, we will have low voltage and heavy current, and that with a small capacity and large inductance we will have a small current and high voltage. But, regardless of the relative values of inductance and capacity, if we reduce the resistance, we increase the current and potential proportionately, and if we were able to reduce the resistance to zero, we would have both unlimited current and infinite voltage, no matter how small the initial power applied.

As understood, insofar as radio communication is concerned, power is radiated usefully from an antenna in two ways: by electrostatic lines of force, which may be considered a function of the volts or potential, and by electromagnetic lines of force, which may be considered as a function of the current. As both current and potential are increased by decreasing the resistance, it follows that a study of re-

sistance would be important.

In radio work, when we speak of resistance, we mean, usually, everything which consumes power in the circuit, and Morecroft defines effective resistance thus: "The effective resistance of a circuit is equal to the amount of power." (watts) "consumed by the circuit divided by the square of the current required to supply this power." Power is expended in an antenna in several ways, and, in practice, the measurement of power loss is usually made by inserting in the antenna circuit a resistance sufficient to cut the current flowing to half its original value.\* When this is done, the resistance inserted is equal to a resistance that would dissipate the same power as the antenna does, and consequently these power losses are all classed together as the "effective resistance" of the antenna. And, as we have seen, anything that is done to reduce the effective resistance of the antenna will increase both current and potential, so it follows that decreasing the effective resistance will increase the proportion of power that is usefully radiated.

It fortunately happens that the measurement of effective resistance is one of the simplest measurements in radio work. The reader is referred to Bucher's "Experimenter Manual," "Bureau of Standards Circular No. 74," and other textbooks on the subject. In these days of C.W., almost any serious-minded experimenter has, or can get with small expense, all the apparatus necessary; and actual measurements of resistance, even if the methods used are not so precisely accurate, will upset a lot of ideas many of us have as to just what is best in antennae, as well as other pieces of radio apparatus.

In order to point out some possible practical uses of the data secured by antenna resistance measurement, we will consider some of the problems that many of us have met at one time or another. For instance, we have often been told that there is one best wave at which an antenna should be operated to secure best results. This has often been considered as having a definite relation to wave length, and has often been stated as at a point about twice the fundamental of the antenna. This is often far from correct, as this point is always the wave length at which the antenna has the lowest effective resistance. Actual measurement of the effective resistance of a number of antennae shows conclusively that no two have the same characteristics. An antenna has a different effective resistance for every wave length to which it may be tuned, and it is well to take a series of measurements over quite a broad band

of waves in order to get as much data as possible from which to draw conclusions as to what changes would be advisable. Fig. 4 approximates the curve obtained by measurement in the case of one antenna. It was desired to operate this antenna over a band of wave lengths. In attempting to tune it, it was found impossible to secure anything resembling a satisfactory condition of resonance at 425 meters, although the fundamental was 350 meters; at 600 and 700 meters the radiation and decrement were good; and at 900 meters, the decrement was again bad. Signals were excellent on 600 meters and 700 meters, but broad, faint and unsatisfactory on the other waves. Examination of the resistance curve indicated the presence of conductors in the

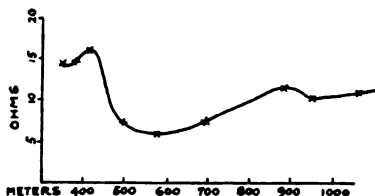


FIG. 4

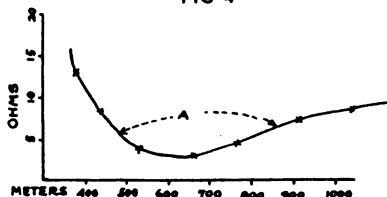


FIG. 5

neighborhood that were at resonance with the antenna at near 400 meters and 900 meters. Thorough grounding of a nearby metal roof completely removed the "hump" at 400 meters, and when the transmitter was tuned to 900 meters, and the key held down while search was made in the neighborhood with a wave meter, it was found that the system of gas piping in the building was carrying heavy current at that wave length. Bonding the gas pipes to other pipes at frequent intervals almost completely removed the "hump" also, and the result was a curve very nearly like that in Fig. 5. Upon retuning, the antenna operated very satisfactorily on all wave lengths between 425 and 900, with no one markedly better than the others, and with decrement and antenna current in direct proportion to the resistance at the various waves to which the transmitter was tuned.

Another antenna measured gave a curve as in Fig. 6. As it was desired to operate this antenna as far as transmitting was concerned on 200 meters only, it was obvious that if it was shortened slightly, this would bring the point of lowest resistance to 200 meters. When this was

\*This value varies with the nature of the excitation current.—Editor.

done antenna current was increased from  $4\frac{1}{2}$  to 6 amperes, and the sharpness of the wave and signal strength were both increased proportionately. Other uses of these measurements will suggest themselves to those who take the trouble to make and use them. It should be comparatively easy to reduce the resistance of an amateur antenna to something like .5 ohm, which would mean an antenna current of something like  $4\frac{1}{2}$  amperes from a ten watt transmitter.

If we admit that the voltage of the antenna bears no relation to the applied voltage, but is the counter-electromotive force set up by the current flowing through the inductance of the antenna system, then it is evident that, as the greatest current will flow at the wave length at which effective resistance is lowest, the combined values of current and potential will be greatest at that wave length also. As the antenna radiates energy in the form of electrostatic waves and magnetic waves, which may be considered as functions of potential and current respectively, it follows that the greatest proportion of the total energy applied will be actually radiated at that wave length at which the antenna has the lowest resistance. As the electromotive force generated by the inductance depends not on the amount of current flowing through it, but upon the rapidity with which the current changes in intensity, it follows that, for a given current, if we increase the frequency (or decrease the wave length) we will increase the potential of the antenna, and so may increase the proportion of power radiated, provided both current and inductance remain the same. If, to reduce the wave length, we remove inductance only, we will have the same current at higher frequency flowing through less inductance, and the increase will be relatively small if any. In fact, if to reduce the wave length it is necessary to remove any great proportion of the inductance, the voltage may actually be lower at the shorter wave. On the other hand, if we lower the frequency (lengthen the wave), we usually add inductance only, and the additional inductance added to lower the frequency really increases the potential of the antenna system. Thus, the values of potential actually secured are not proportional to the changes of frequency through a given inductance (which would result in higher potential for higher frequencies) but often the reverse, as they are the result of the counter-electromotive force generated by the amount of inductance used to secure the wave length desired. When we decrease the wave length, we immediately begin to "climb up" to a point of higher resistance on our resistance curve and cannot maintain the same current as at the longer wave.

Both current and voltage fall off, and we do not radiate nearly so large a proportion of the energy we apply to the antenna. Consequently, there seems to be something wrong with the "dope" we have had for so long concerning radiation resistance. If we concede that the power actually radiated depends on both current and potential, then, knowing that these values are both greatest at lowest effective resistance, that portion of the resistance curve close to the fundamental cannot be considered as radiation resistance except inasmuch as the higher frequency at the shorter wave length increases the potential. In fact, actual results as to signal strength bear out such assumption, and attempts to operate C.W. transmitters close to the funda-

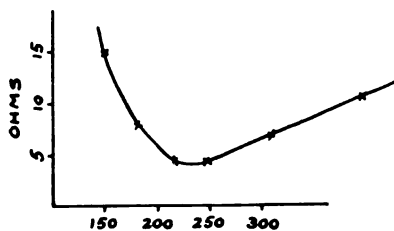


FIG. 6

mental wave length in order to take advantage of the supposed higher "radiation resistance" have proven that "it can't be did." It is often better to cut off part of the length of the antenna in order to reduce the capacity, so as to be able to operate the antenna at its point of lowest resistance. This does not necessitate removal of inductance and consequent lowering of potential, and, in several cases, has resulted in marked increase in signal strength, even when the height of the antenna was lowered materially.

As the effectiveness of an antenna in actually transmitting signals to distant points depends not only on the power actually radiated, but on its effective height also, the amateur is confronted by a "pretty problem" indeed. In consequence, so as not to decrease that precious "effective height," he puts in enormous ground systems, uses very large conductors, puts up many wires, and goes to all sorts of extremes in order to better conditions. And much of this effort is wasted, because we have never had any definite rule to judge as to the effectiveness of these various measures. Actual measurement of resistance gives us that "rule." For experiment recently I put up a two-wire antenna of the same length as a six-wire one, and very much to my surprise found that the two wires had less resistance than the six. And the two wires actually gave greater antenna current than the six. However, when

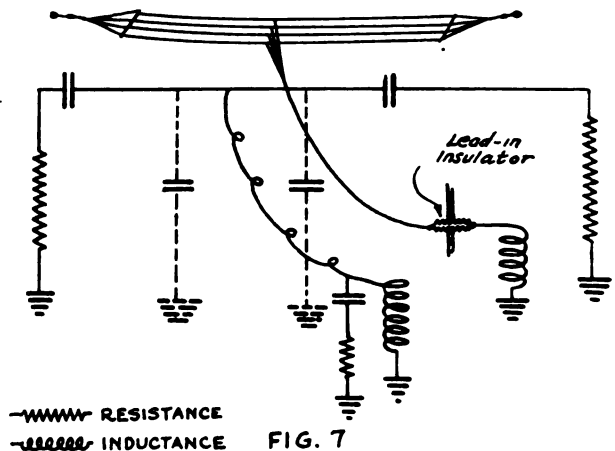
the two wires forming the lead-in were twisted together, the resistance actually increased from 6 ohms to 14 ohms, with correspondingly lower antenna current and signal strength. This was surprising, as I supposed that twisting them together would result in lower capacity only. After measuring a few antennae, I came to the conclusion that a good many of the opinions that I had formed concerning the effectiveness of various methods were entirely wrong. This especially, because the conditions disclosed by measuring the resistance were in exact accord with what the station was actually doing in the way of signal strength at distant stations. One station in particular has been a "Jonah." We have built antenna after antenna, tuned and retuned, piled on the power till something "blew up," secured antenna currents varying from 6 to 40 amperes, but with the result each time that when we had the greatest antenna current we had the weakest signal. Measurement of resistance at last disclosed the difficulty. The resistance curve showed several "humps" at critical points, was high over the entire range of waves, and the remedy was obvious. The ground system, while extensive, consisted of three long copper strips, buried deeply, and was totally inadequate for the station.

When one begins to lower the effective resistance of an antenna some surprising conditions are disclosed. Antenna current goes up, of course. Insulators begin to "let go" that have been perfectly satisfactory for a long time. The antenna begins to brush, and with C.W. especially, things get hot in the most unexpected places. Losses are disclosed that were not at all evident before.

Fig. 7 shows an antenna and the equivalent diagram of the effect of its various parts. It will be noted that the insulators have been shown as condensers shunted by resistances, including the entering insulator; and that is really what they are. Unfortunately, many of the insulators furnished for radio work are not only made of material that has high dielectric losses, but they are so constructed as to have considerable capacity in themselves. It is evident that current will flow through their capacities in the direct proportion that the sum of these capacities bears to the capacity of the antenna as a whole. One antenna that I measured showed such a surprising value of capacity that the insulators were removed and measured separately, and it was found that the capacity

of the insulators represented one-third of the entire capacity of the antenna. That means that one-third of the power that actually got into the antenna passed through the insulators, and, consequently, could do very little toward making signals at the distant station. If the resistance of the path through these insulators were high, due to various losses in circuit, then these losses would be included in the measurement of effective resistance. But, should the insulators be made of good material, free from dielectric loss, and connected in such a manner that the circuit through them had low resistance otherwise, the measurement would disclose low resistance, and yet a considerable portion of the power applied would pass through them and do no useful work. In one case it was found that the current flowing in the antenna lead was 2 amperes less outside the entering insulator than it was when measured inside. Yet, when a new entering insulator was provided and this loss corrected, the antenna resistance remained practically the same.

When we sum it all up, it is evident that most of the methods used by amateurs to improve their stations were based on sound principles, and for that reason were effective. Many of them were not nearly so important as supposed, and it is entirely probable that many things that can readily



be done to improve the effectiveness of our stations have been overlooked entirely.

Consideration of the problem from this standpoint seems to me to indicate that the antenna system is probably the least efficient part of the equipment that goes to make up a radio station, and it is certain that it can be very greatly improved indeed. In fact, an antenna has been experimentally erected, of size suitable for amateur use, which has a resistance of less than .2 ohm; this would mean, with a 1000

watt transmitter, 33% efficient, an antenna current of about 40 amperes, and that would certainly win in any Trans-Atlantic test.

As to receiving conditions, results are in all cases as advantageous. Here we have the impressed potential applied to the antenna as a whole, rather than to a portion of the inductance. Again, the current in the antenna is limited only by its resistance, and the potential is that generated by this current passing through the inductance. Therefore the amount of energy that will accumulate in a receiving antenna, all other conditions remaining the same, is in direct proportion to its effective resistance.

Suppose we have an antenna of 12 ohms resistance and that when the receiver is coupled to it, the added effective resistance

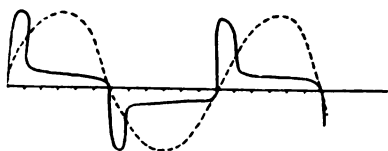


FIG 8

of the receiving set is equivalent to 2 ohms. In such a case, 6/7 of the power received is consumed in losses in the antenna itself, and only 1/7 in producing the signal. However, should the antenna resistance be reduced to 1 ohm, the effective resistance of the receiver remaining the same, only 1/3 the power received will be expended in the antenna and 2/3 will be available for producing the signal. In practice, this 2/3 is not required for signals of appreciable strength, and the effective resistance added to the resistance of the antenna by the secondary of the receiver as ordinarily coupled and used is considerably less than the estimated two ohms, but the principle is as illustrated above. And with the low resistance, the antenna presents higher impedance to frequencies other than those to which it is tuned, and so tunes more sharply and is much superior in regard to selectivity. These results and the conclusions drawn are in exact accord with results obtained at stations at which such changes have been made. Of course this explanation takes no account of the "negative resistance" characteristic of regenerative receivers under certain conditions.

Now, to "hark back" to the article in February 1921 "QST" and the subsequent discussion. Certain questions were asked, but the discussion did not go very far in answering them. I believe that when these problems are considered in the light of the explanation given it will be clear that the results obtained are in direct relation to the principles outlined.

One thing is as yet unexplained. Why does the little tube set with 5 or 10 watts cover the same range that the 1 K.W. spark does? I can so far see but one explanation that seems at all probable. Aside from the question of the relative sensitiveness of heterodyne reception the explanation perhaps lies in the form of the wave emitted by a tube transmitter. It is possible that the wave form of the high frequency current generated by the tube transmitter is such that the current rises sharply at certain points and so generates in the inductance of the antenna a considerably greater potential than would be the case if the wave was a pure sine wave. Referring to Fig. 8, if the wave was as the heavy line, the potential resulting would be approximately six times as great as that resulting from the pure sine wave, as shown by the dotted line. [But the harmonics generated by this non-sinusoidal wave form are awful!—Ed.]

Actual oscillograms taken of the plate current in vacuum tube transmitters show great wave form distortion, and conclusions drawn from them indicate clearly that the greatest efficiency results when conditions are such as to produce maximum distortion.

Consideration of the foregoing leads to the inevitable conclusion that appreciable radiation can only take place from an antenna when the phase relationship between the current and potential is such as to secure the greatest possible values of current and potential for the power applied.

It is a well known fact that radio frequency currents can be transferred from one circuit to another at non-resonance with almost equal efficiency as at resonance, but in this latter case the values of potential and current are so small (current and potential are in phase to a great extent under non-resonance conditions) that very little radiation results.

## Amplifiers versus Detectors

By L. Q.

WASHINGTON THOMPSON wasn't this negro's name but that's near enuf right.

He used to brag about the way his mule could kick.

One day a neighbor asked how well the mule worked.

"Wuk? Dishyeh mule don't wuk. He kick! Dot his speshulty—yessah—he kick—he don't wuk!"

Moral—Don't think you've a good receiver because it's got lots of kick—because 9ZN comes in all over the place. Does it go somewhere? Or does it just stay near-by and kick?

# The Third and Fourth District Radio Convention

*Reported by Chas. A. Service, Jr.*

**T**HIS is the story of a bang-up convention the boys of the Third and Fourth Districts staged some six weeks ago in the City of Speeches.

No, it is not a post-mortem because that convention is far from being a corpse in the minds of those who heard the call and hurried to the Hotel Raleigh from Pennsylvania, New Jersey, Delaware, Maryland "and all points south" on a zero February morning to find one of those warm southern receptions waiting at the station and hotel; and in about the space of one electron emission, mind asserted itself over matter and every ham, super-ham, near-

he's wrong, two "bottle-workers" fingering knuckle-dusters and a lead pipe all aglow to tune up on an unprotected spark man, hams hiking hither and yon like unattached electrons until attracted to some positive young oracle with more regard for a flow of soul than the pure light of reason, hams in groups, in festoons, in waving lines and tight pressed knots, hams freely oscillating and hams damped down by OW's or YL's, all actuated by a single impulse, to get all out of the Convention the Convention had to offer—and they weren't disappointed!

By the way, Hill, 4GL, of Savannah, Georgia, and Harrod, 4II, of Orlando,



ham and hamlet was spreading his doctrine or lapping up knowledge from somebody else's think-tank. Whoso wanted an audience had but to work his jaws faster than his neighbor and straightway he was surrounded by an eager, buzzing group like flies around a gum-drop; subject matter made no difference. There were hams from whose lips dripped facile cosine-thetas and components and characteristics and things, while the more earth-earthy took a worm's-eye-view of radio and covertly asked who wanted to buy a spark set cheap.

But this is an ante-room impression; a dozen steps, the rapid exchange of words and notes with the door monitor and the lucky lad or lass passed within the portals of the exhibit room, to be greeted by that sight of sights, the radio ham at ease. Imagine exhibit tables around the walls manned by designing demonstrators and sweating salesmen with one eye on business and the other on their vacuum tubes, surging crowds of craning hams, knots of open-mouthed Marconis around the leading exponent of C.W., itching to tell him where

Florida, were there from the Fourth District, sent there by popular subscription raised by the boys in those States to represent them. How's that for A.R.R.L. spirit, fellows? And those contributions were raised in about ten days, too!

When things began to look like the 1907 Wall Street panic, the first meeting was announced and by dint of much persuasion the O.M.'s and O.W.'s were induced to sit down and keep quiet while Mr. Terrell, Chief Radio Inspector of the Department of Commerce, formally opened the Convention. That opening speech started things off right; here it is verbatim. What is your reaction?

## Officers, Members and Friends of the American Radio Relay League:

"I thank you for your invitation to attend the Third Annual Convention of the Third and Fourth Radio Districts.

"I have been asked to tell you that you are welcome here. I think you would prefer to be shown and this we shall endeavor to do. No one need be told he is welcome in



Washington. It is your city. You will also be welcome in Room 509, Department of Commerce, and a visit by you will be appreciated.

"I had the pleasure of attending your National Convention in Chicago last August. At that time I was requested by our Secretary, Mr. Hoover, to obtain from the members of the American Radio Relay League their views as to where the Department of Commerce can be of the best service to them. I renew that request.

"You have no doubt seen in the newspapers articles concerning the radio conference which the Secretary will call, at the request of the President, to investigate the development and use of the radio telephone. I understand the American Radio Relay League is to have a representative on the committee which will conduct this investigation. You will have an opportunity to present your views and make recommendations which may be useful to the commit-

|                                   |       |
|-----------------------------------|-------|
| Third District, February 10.....  | 1,664 |
| Fourth District, February 10..... | 294   |
| Fifth District, January 31.....   | 614   |
| Sixth District, February 8.....   | 1,474 |
| Seventh District, February 2..... | 644   |
| Eighth District, January 31.....  | 2,250 |
| Ninth District, February 8.....   | 2,664 |

Total .....14,179

"An increase of approximately 4,000 since the first of last July

"Receiving stations are not recorded and we have no reliable information as to the number. I expect the Secretary would be willing to give another cup to the amateur who can guess the exact number, if he can prove it.

"Broadcasting promises to become one of the most valuable functions of radio, if properly protected and regulated. It will no doubt be one of the most important problems to be considered by the coming radio conference and I hope some plan can



tee in reaching conclusions affecting the use of radio by the amateurs. It is fortunate for you that you have an organization composed of practically all of the foremost amateurs of this country, recognized as being law-abiding, unselfish, and progressive. This organization is Uncle Sam's best training school for radio operators and radio engineers of the future.

"There is at present, and I hope there always will be, just one amateur radio organization of the amateurs, by the amateurs, and for the amateurs. Your power and influence for good can be fully realized only through united and unselfish effort. I hope there will never develop any personal jealousies or factional differences to disrupt your splendid spirit of co-operation, so valuable to yourselves and so helpful to us.

"It may interest you to know how many licensed amateur radio stations there are in the United States, as indicated by the latest reports from each district.

First District, February 8.....2,440

Second District, January 24.....2,135

be devised which will insure its successful use. The benefits to the public through radio broadcasting are almost unlimited. The service rendered should be determined by the public if its full value is to be realized.

"You can lead a mule to water, but you can't make him drink. You can broadcast what you like but the public will not listen to it if it is not what they want to hear.

"With the rapid development of inland radio, amateur stations and broadcasting, we are confronted with the problem of investigating complaints of interference. With our present force we have been unable to give much attention to inland radio. Until recently radio has been in the hands of people who had some knowledge of its use. Now we have receiving sets in the hands of farmers, farmers wives, bankers, grocers, and everybody who wants to be fashionable. They have no knowledge of adjusting the apparatus; in fact, I have heard much of the apparatus is so simply constructed that selectivity is impossible.

"I think we are going to find it necessary

to call upon the American Radio Relay League for volunteers, dollar-a-year men, to act as deputy radio inspectors in each State, until we can get an appropriation sufficient to meet this emergency. I believe we are going to find it necessary to have a radio inspector in each state, possibly two in each state, provided with a transmitting and receiving set, to keep in touch with actual radio operating conditions, regulating the schedules and giving advice to the new users of radio. As I view it, there is a big job ahead of us and we will need your co-operation.

"I am reasonably sure there must be a change in allocation of wave lengths.

"I believe it is going to be found necessary to ask the amateurs to release the special amateur wave length of 375 meters to make room for broadcasting. What do you think of the following wave lengths for the amateurs: 175, 200, 225 and 250 meters. And what do you think of assigning them something like this: 175 for tele-

cial Amateur operators license? To be issued to amateurs who have had, say ten years experience; code speed 15 or 20 words a minute. But to be issued only to amateurs who have not had their licenses suspended or have been fined for a violation of the law. Such licenses not to be renewable if a violation is recorded against the holder.

"We would like to know if the amateurs desire us to print monthly a list of the new amateur stations licensed; something like the Radio Service Bulletin (wild applause). We may not have the money to do this but if it is wanted and needed we may be able to get the money, if we can show there is sufficient demand and need for it. The cost of publishing our lists comes out of our appropriation but this money is not returned to us when the publications are sold. It goes back into the Treasury through the Printing Office.

"Before leaving you, I want to thank you for your splendid co-operation during the



The Banquet on Feb. 18th

phones and broadcasting; 200 to the beginners, either spark or C.W., during the period of their first license; 225 to CW exclusively after two years' experience, and 250 to special amateurs for either spark or CW. To do this it will be necessary to have a change in our present law to provide for the use of 225 meters by the general and restricted amateurs, as they are now limited to 200 meters. This question may come up at the coming radio conference and you should have your recommendations ready.

"You have demonstrated you can work across the Atlantic on 200 meters. Unless you contemplate a test with China you should be willing to release the 375 meters wave length, which will be badly needed for broadcasting.

"What do you think of our having a Spe-

cial Amateur operators license? To be issued to amateurs who have had, say ten years experience; code speed 15 or 20 words a minute. But to be issued only to amateurs who have not had their licenses suspended or have been fined for a violation of the law. Such licenses not to be renewable if a violation is recorded against the holder.

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dio Measurements" was the subject and was followed by a whole raft of good papers and speakers, dealing with antennae and ground, wavemeters, CW design, theory and operation, audio and radio frequency amplification and about everything else worth while. These papers will come out in QST soon.

Came evening and those with sufficient strength and newcomers were turned loose again in the exhibit rooms and told to go to it. Those with the hoof and mouth disease, who had been hoofing it around all day, withdrew to their rooms to talk it over all night; many spirited arguments took place behind locked doors. An absorbed group gathered about the code table where speed birds scribbled fast and furiously and someone won a pair of Baldwins.

The second and last day of the Convention went off with a rush, starting with a fleet of plate glass rubberneck buggies that took the whole crowd to the Anacostia Naval Air station to see NOF and the multiple tuned antenna and then back across the Potomac to that gray haired father of all high powered stations, NAA, just in time to "hear time" at noon. Some noise! That picture of the gang was taken with one of those rotary camera affairs that pivot on a stand and "shoot" only one section at once; they say Bradley Martin of the Phila. Amateur Radio Association tried to fool 'em and get in the picture twice after the camera had started by running from one end to the other before the camera got there but the camera man tripped him on the run and held him down til it was over.

The afternoon saw everybody lined up for the rectifier battle in which Mr. Kruse backed the chemical rectifier, Mr. Baker the kenotron, and Mr. Tyzzer the Amrad "S" tube. When every ham had satisfied his scientific appetite and stretched preparatory to shunting his neck with a hard boiled collar for the banquet, "The Young Squirt" blew in, made himself quite at home—which was what he paid the money for—and proceeded to write "The Old Man" his impressions of the Convention and especially the banquet. Here's what he had to say:

"I am here to tell the world that I was at the Third and Fourth District Convention! That is, I arrived just before the banquet. Were you there, Old Beeswax? If not, why not? I'll bet you couldn't have found anything rotten at that Convention with a fine toothed comb.

"When I arrived at the Hotel Raleigh I found about 'steen hundred Hams and Ohmlettes on the job; they were grouped together in little knots talking about everything from leaky dielectrics to leaky roofs after the crowd has finished erecting a fifty

foot stick thereon. A little fellow who looked about as old as the bird who crawls from the Pears Soap bathtub took me in tow and gave me a dissertation on grid bias. He was some little fellow. more power to him!

"I also met the Y. L. and she sure is one of the boys; got to admit I couldn't make the eyes behave. I'm here to tell you, you ancient, tottering old knocker, the Y.L. is O.K. She talks like a regular fellow and she is sinusoidal all the way. Hold me back, crowd, my hand is trembling.

"Then the exhibits; was there much on exhibit that was rotten? I guess not! Every product displayed was A-1, even to the young feller that White and Boyer of Washington had on exhibition. He was courteous and thorough in his demonstration, but it ain't right, gang, for any he-animal to be so good looking.

"Hewitt and Meyers and their gang dragged me out to chow and we talked over Godley and things un-Godley and Prohibition. When we had finished we were in fine spirits and Hewitt was shooting traffic across the pond using a cat's back on a winter's night as a master oscillator. Gents, the spirits are willing to show how weak the flesh is.

"After coaling up, I was introduced to the Back Bone (but not the Jaw Bone, that's Warner) of our A.R.R.L. I met Mr. Maxim! I guess he suspected that I had stolen a "P" tube because his big round eyes looked me through and through, but b'lieve me, he's a fine fellow, gang, and I wish that all of you could shake him by the hand as I did in the Hotel Raleigh. Seriously, though, he seems anxious to meet us poor fish. Speaking of which, I want say right here that I admired Mr. Maxim's soup and fish suit. It did not look rotten, Beeswax, it looked magna-glorious.

"Now comes the honorable banquet. Oh boy! That banquet! Was it rotten—NIX—many times NIX. The only rotten thing was the gentleman whose voice wended its way to the loftiest heights, an African voice with a two hundred meter wavelength, a 10-amp. radiation and an illegal decrement, which proclaimed to the adolescent radiators that its owner was a Sheik. It would take all the august gallantry of the gentleman for whom the hotel was named to admit that he was a Sheik. He was a CRIME.

"Say, you ancient Tree-Toad! I'm here to chortle that Kruse and Service accompanied by Haig and Haig and that Third and Fourth District Committee know how to get up a banquet. For once in our young lives we all had enough to eat. I saw one ham stow away two men's feed, put six or eight slices of the lignum vitae in his pocket, declare that that was what he called

a man's feed, rub his hands together and saunter off. His name is Meyers.

"The fish was clean, even though it was called Potomac River Bass. Chicken soup was served in fore and aft cups. Some spooned it, some mouthed it, others used it as finger bowls. The soup was all there but Bidwell said he guessed the chicken waded through it with gum boots on.

"But I've got to cut the banquet proper short, as I want to get to the other part. Some show! The ham from Baltimore is a good actor, he knows his stuff but I want all you fellows to glimpse his partner as far as it is in my power to portray her. I stood by quite stoically during the first part of the performance but when the honorable ham fell asleep and the hamerino appeared to him in a dream and a smile and a dress made of molecules and electrons, my none too constant decrement got away from me and my pulse broke all speed records. Gosh, gang, it was good!

"By this time, Kruse was batting hell out of the air with a Magnavox. Kruse was Chairman and Will H. Hays never acquitted himself better than our Kruse. Chief Inspector Terrell put over a short speech, followed by that ever popular Inspector Cadmus. Hiram Percy Maxim was then introduced and spoke words of wisdom, as is usual with him, followed by Warner and Schnell outlining the future policies of our "QST" and its Operating Department. I must mention Tom Appleby's description of 3ZO which was illustrated by a stereopticon. I am sure that it was appreciated by all, but after Tom had described the home life of a whole family of 250-watt tubes, who shall say that many a winter overcoat was not hocked the next day in Washington?

"The end came at last as ends usually do and I was whisked away and introduced to "Chain Lightning Hill," who acknowledged me in the dignified words, "How are you, Scup?" Then he dragged me off to see 3ZY with his tribe of rebels, and after riding ten days on the Washington 'Lectrics, we arrived half an hour later, to be greeted by a hearty "Welcome, fellows!" Just imagine it, at twelve thirty A.M. he made us *welcome*. Is that rotten, Old Wouff-Hong? Dunnam even broke out a flock of sandwiches for us! That's what it means, crowd, to belong to this A.R.R.L. of ours. Fellers like Dunnam abound in the radio fraternity; may their shadows never grow less!

"Gosh, the wife is yelling for me to go to the store. The raisins have given out again and no one with any pep can keep house nowadays without raisins. So long, gang. Cul, but anyone who wasn't at that Convention missed something."

"The Young Squirt" got about everything in that went on at the banquet, ex-

cept the results of the election of next year's officers. Baltimore received the highest vote for the next Convention city, with Bateman, 3APT, of that city President of the Third District Council and Convention; Harry Lyon, 3RP, Vice-President; and H. A. Snow, 3ZE, this year's Convention Manager, next year's Secretary-Treasurer. The third District looks to Baltimore and these men to put across an even better convention in 1923 and backs them to the limit—but they'll have to go some!

## Trump Passes On

WITH much sorrow we have to chronicle the death of Robert Kitts Trump (9BT), which occurred on February 14th at the home of his grandparents at Ottawa, Kansas. His biography appeared in "Who's Who" in but the February number of QST.

Bob was one of our old stand-bys in eastern Kansas and his absence will be keenly felt. He was only twenty-three years old, death resulting from tuberculosis following a long illness of four years which came indirectly from influenza contracted while in the Navy during the recent war. He was sent to Phoenix in an effort to improve his health but was not materially helped and returned to Kansas for his last days.

9BT was in operation up to the last and was a good live A.R.R.L. station, doing much good work in its territory. We join in an expression of sincere sympathy for Trump's relatives and many friends.

## 3ZO Tests With Venezuela

3ZO, the station of Mr. Horace A. Beale, Jr., at Parksburg, Pa., is participating in radio tests with Venezuela thru arrangements with the state Department of that country made by Dr. E. H. Valutini, 3d, 3AAE, of Philadelphia.

The tests commence on March 15th and continue until March 25th, covering the hour from 10:30 p.m. to 11:30 p.m. NAA time. The Venezuelan stations participating are stations AYA, AYB and AYC. One of these transmits promptly at 10:30 for five minutes, then alternating with 3ZO in five-minute transmission periods.

3ZO is on 350 meters, C.W., for these tests, while AYA, AYB and AYC use 1600 meters, tube C.W., output 1 k.w. Listening stations in Venezuela will continuously tune from 200 to 350 meters, so there is a good chance of other American amateurs being heard as well.

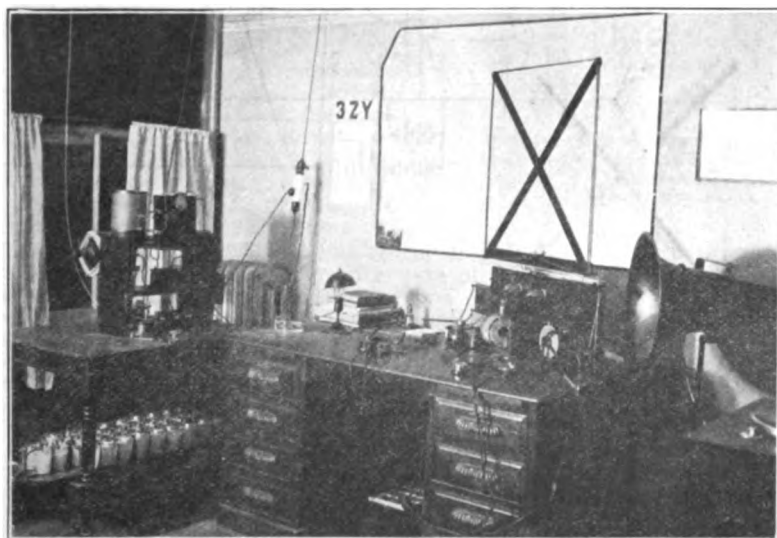
We certainly hope these tests will be successful, as it will establish amateur communication with South America for the first time and, as our Transatlantic Tests did in France, probably open the way to another international A.R.R.L. trunk-line.

## The Loop Receiver At 3ZY

By L. M. Dunnam

**A**FTER monkeying with loop reception on several occasions with various hook-ups and nil results during the past two years the writer had long since given it up as a bad job and impracticable with less than an Armstrong super-heterodyne circuit. However, one night during the latter part of January, when static was unusually bad, the antenna and ground were disconnected from the receiver and by careful tuning

make-shift loop a permanent one was constructed, 25"x26", wound with four turns of wire and a still lower tap taken from the secondary coil. This loop was mounted on top of the receiver cabinet, revolving on a pivot, and controlled by means of a pulley and cord-belt arrangement with a knob at the lower right-hand corner of the receiver cabinet; this in order to avoid body-capacity effects when using the hands near the loop coil. Still better signal strength was had



two C.W. stations, 1ARY and 8AWP, were picked up, signals QRZ but readable. The possibilities of a loop as an enlarged portion of the secondary coil, allowing greater absorption of energy, were quickly realized. An old discarded frame about 19"x19" wound with three turns of small wire was dug out of the junk pile, propped on top of the receiver cabinet and connected in series with the secondary coil, a lower tap being taken off of the latter to compensate for the added inductance of the loop. In a few minutes about a dozen other C.W. stations were logged, 1ARY and 8AWP much stronger than without loop. With the result that the writer is now a confirmed advocate of the loop for relay work. In nearly all cases the signals were easily read, to the almost utter exclusion of static, "mush" from sparks, interference from NAA and other sources.

After the results were noted with the

with this loop. However, since the photograph was taken, another frame has been mounted in the same manner, the present one being 25"x42" and wound with three turns of No. 18 enameled, and corresponding improvement in results has been noted.

The loop is not efficient for spark. The most of the few logged were heard with the detector tube oscillating, hence on their mush notes, though several were heard on their true tones. On the other hand, KDKA, WBL and other radiophone stations were heard perfectly clear with fine audibility, in fact audible a few feet from the loud-speaker at times

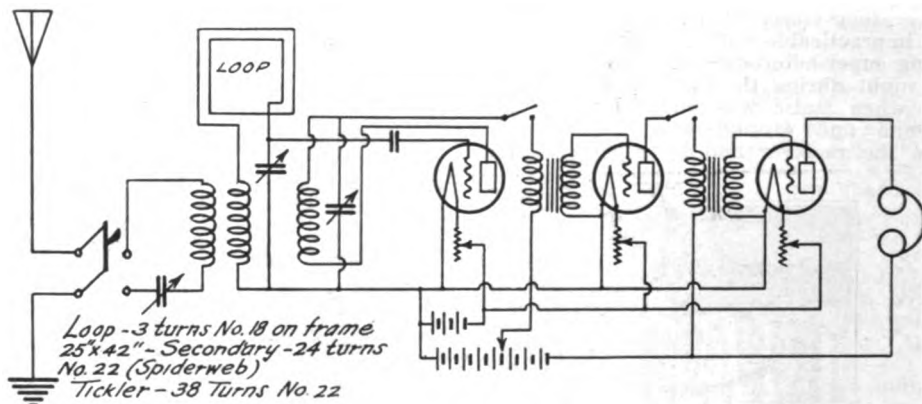
Practically all C.W. stations that can be heard with the antenna and ground are readable on the loop. While the sparks rarely are heard and interfere only in extreme cases from broadly tuned stations such as 8XE when near the wave being worked, distant low-powered C.W. sets,

down to five and ten-watts are easily worked. The furthest stations heard at 3ZY on the antenna and ground have been heard on the loop, the most distant being 6ZZ located at Douglas, Ariz., who was read with perfect ease. Break-in work has been carried on with many stations, 1's, 2's, 8's and 9's included.

It has been argued that much of the energy in the loop is obtained from a coupling

Since the loop has been in operation, about four weeks, an even 200 stations have been logged, the majority of which were readable on one step only.

If anyone trying the stunt fails to hear the usual 'racket' when he turns on his tubes, don't get disgusted and ditch it, just try a little careful tuning and hear the C.W.'s roll in, minus the nerve-racking extraneous noises.

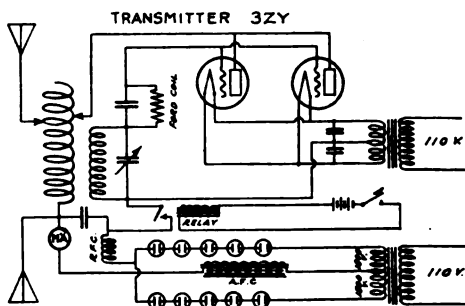


effect to the antenna lead. While it is admitted this may be true to a certain extent the directional effect of the loop and various experiments with the antenna lead, such as grounding it and shifting its position, go far towards disproving this claim. The directional properties of the loop on C.W. signals are not very pronounced but they are so as to sparks and in every case where the location of a spark transmitter is known the loop indicates its true direction, regardless of the relation of the loop to the antenna. Local DX sparks can be so reduced in strength as to permit distant C.W. stations to be read within five or ten meters of the spark's true wave.

The beauty of it all is that there is absolutely nothing remarkable about the performance at 3ZY, and the average station with a good one or two-stage audio-frequency amplifier can duplicate it. It is hoped every DX station will give it a try-out in the interests of a much larger volume of traffic which can be handled through interference and static.

While trouble may be experienced in obtaining good results from the loop when variometers are used, due to their minimum inductance, it is only a matter of about one hour's work to make up a couple of spiderweb coils of proper inductance for a tickler and secondary and a loop such as is in use by the writer, which can be readily connected in any detector circuit. Solid wire, No. 18 to No. 22, is recommended for coils and loop. Litz was tried on both, with results no better, if as good.

Detailed wiring diagrams of the transmitter and receiver and a photo of the station complete are illustrated herewith. The output of the transmitter is from 3.8 to 4.2 amperes with an input of from 450 to 500 watts. The furthest points worked to date are Minneapolis and New Orleans, with signal reports from Mexico and Porto Rico. The antenna system, a one-wire



slant 80 feet high and a three-wire counterpoise extending in opposite directions from each other, is quite a handicap, which cannot be overcome on account of physical conditions.

Much credit for the performances and appearance of the station is due Mr. Herbert A. Wadsworth (3JJ), second operator at 3ZY.

In conclusion, the writer asks that anyone giving the loop suggestions a tryout kindly advise him of the results.

## *The Remarkable Work of 6XAD*

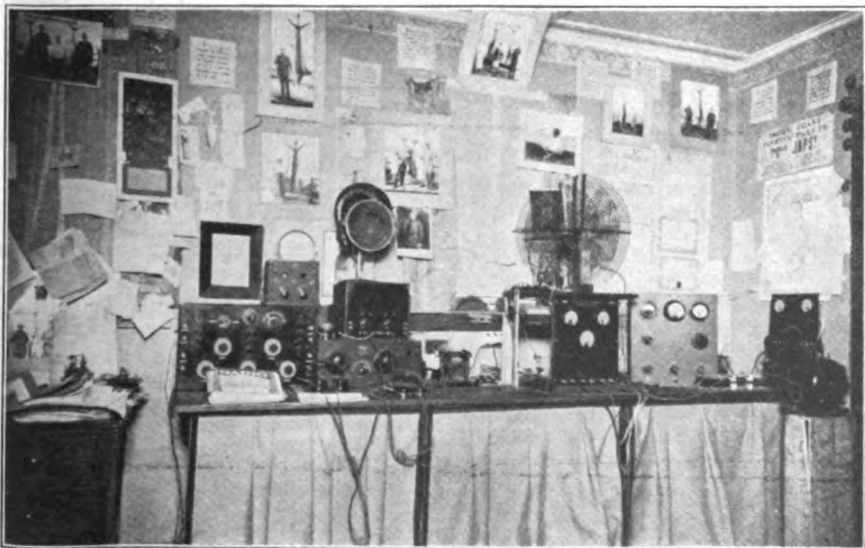
**I**N a recent issue of QST prominence was given the reception of signals from 6ALE at 1ES, it being stated that to the best of our knowledge it was the first time that 6-signals were heard in New England. Altho that claim has been disproved by the buzz of comment that immediately resulted in the unearthing of a couple cases of prior reception of sixes in the First, most of our correspondents overlooked the fact that we were talking about these two districts in particular, and cited many better low powered transcontinental or near-transcon records. Even so, however, it has brought a lot of interesting data to light and therefore serves a useful purpose.

Most of these records center around one station, strange to say, and are in existence largely because of the most remarkable work of station 6XAD, Mr. Lawrence Mott, of Avalon, Catalina Island, California. We believe we are safe in saying that Mr. Mott is doing the best work of any American amateur today in point of both transmission and reception, having repeatedly copied stations all up and down the Atlantic Seaboard and in turn having had his own signals reported many times from a larger number of points in the same territory. And it has not all been bare reports of signals heard—6XAD has frequently worked many of these stations,

passing messages back and forth with the ease of local communication. Of course equal credit belongs to the various indi-



Mr. Laurence Mott, 6XAD



Mr. Mott's station—6XAD

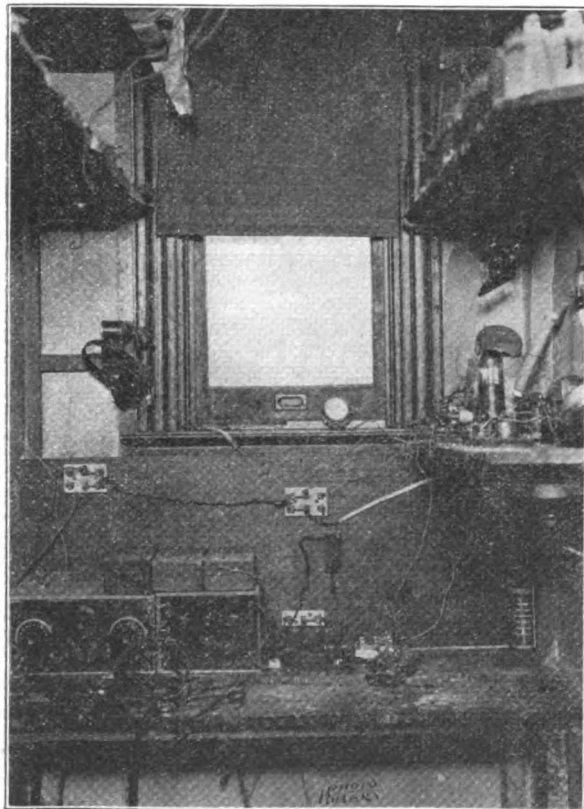


vidual stations who have participated, but these records are possible largely because of the existence of 6XAD—he is the kingpin in the story. And we do not see at 6XAD a flock of 250-watt tubes as characterized 1BCG, nor yet Armstrong-Super tuners, but a transmitter of four Western Electric VT-2's and a conventional tuner using a detector and generally one, sometimes two, stages of audio amplification! All of which goes to show that it can be done.

Our hat is off to Mr. Mott and his confreres who are doing this splendid work in the advancement of Amateur Radio and C.W. in particular. As a typical example of 6XAD's reception, take 3FS at Philadelphia, using generally three of the tubes so conservatively known as "5-watters," but who, using but two of them, has been heard dozens of times at Avalon. Isn't that going some? And 3AQR at Hershey, Pa., who



Above, 3FS of Philadelphia. Below, 3ALN in Washington.



not only has been heard on four occasions but has been worked for a couple of hours and messages passed, 3AQR using one 50-watt. And 3ALN in Washington, also with a single 50-watt tube, who has been worked three times and messages exchanged. 8JL in Cleveland and 9AJA in Chicago raise 6XAD and chew the rag without schedule and almost whenever they want to, almost as if they were in the same city. 8AWP in Syracuse, on their small set of three 5-watters, antenna current 2.4 amps., same old story; 6XAD copied in Syracuse twenty minutes after daylight. We also have record of 6XAD working with 8BSS and 8BUM in Cazenovia, N. Y., who were audible a hundred feet from the phones, and Mr. Mott reports signals from 8BO, Detroit, one 5-watt; 8VY, Kalamazoo, two 5-watt; 3EM, Baltimore, one 50-watt, from whom a complete message was copied; 3LR, Washington, and 1ARY, Burlington, Vt., each using a single 50-watt; and 4FT at Atlanta, using two 50's. 6XAD of course is reported from many other places, including 1BLN, 2FP, 3HJ, 3BHW, 3JJ, 6ZAC in Honolulu, Canadian 3JI and 4CB, 8KW, 8KF, 8EW, 8AXI, 8ZAC, 9JQ, 8BGD, 8ZG, 8BRL, 9RC, 9ZN, 9JQ, etc.



We are fortunate in having a photograph of 3FS, which belongs to Mr. Chas. G. Benzing, of Philadelphia. The three 5-watt tubes are supplied with 700 volts from a 16-jar chemical rectifier, putting 2.6 amps in an inverted L aerial 45 ft. long of 6 wires, 60 ft. high. With two tubes, as used when reported at 6XAD and incidentally 7FQ at Tekoa, Wash., the antenna current is 2 amps. 3ALN, H. F. Hastings in Washington, D. C., uses a single 50-watt-er with about 1400 volts from a chemical rectifier, the tube space current being 150 mils and the antenna current 3.5 amps. Mr. Hastings reports that 6XAD has been heard frequently, generally swinging slowly, and will fade out a few seconds at a time and then be in steady for a half hour.

All of the above transmission from 6XAD has been on the "low-power" set of four 5-watt tubes, I.C.W. Mr. Mott also has a

100-watt set on 370 meters, straight C.W., which has been reported from Hamilton, Bermuda!

All of these results are truly wonderful considering the low powers used. They are second in distance only to the remarkable performances in the Transatlantics, but this work between Avalon and the east has been done on no pre-arranged schedules and almost nightly 6XAD has been in communication over some such distances. It should be borne in mind, to be fair, that a so-called 5-watt tube is capable of much greater outputs and that most of the men using them are probably getting 20-watts out of them, but the results are remarkable none the less. And the beauty of it is that any station with proper antenna and ground system and properly adjusted can duplicate these performances!

## Chicago Council Gets Smith Cup

**T**HE Chicago Executive Radio Council has been awarded the S. W. Smith Cup for the most outstanding achievement in Citizen Radio during the summer season of July 1—November 1 of last year!

As announced in QST last July, Mr. Seymour Wemyss Smith of "The Hartford Courant", ardent member of the A.R.R.L. and the Radio Club of Hartford, offered a silver loving cup to be awarded for distinctive achievement in the amateur world under the auspices of the League, and Mr. S. Kruse was good enough to act as Chairman of a Committee of Judges and handled the matter with his customary thoroughness. His committee consisted of one man from each radio district, as follows:

|  |      |
|--|------|
| Irving Vermilya, Marion, Mass.....           | 1ZE  |
| A. A. Hebert, Nutley, N. J.....              | 2MP  |
| S. Kruse, <i>Chairman</i> , Washington, D.C. | 3ABI |
| E. H. Merritt, Atlanta, Ga.....              | 4XC  |
| John M. Clayton, Little Rock, Ark....        | 5ZL  |
| A. E. Bessey, Sunnyvale, Cal.....            | 6ZK  |
| Royal Mumford, Vancouver, Wash.....          | 7ZJ  |
| A. J. Manning, Salem, Ohio.....              | 8ZG  |
| R. H. G. Mathews, Chicago.....               | 9ZN  |

These judges were all asked to submit nominees for the cup from the district they represented, and meanwhile an article in QST made a similar request of the general membership. Twenty-odd entrants were received and tabulated by the Chairman and submitted to the Committee for voting. Scoring was on the following basis: a vote for first place counted 5, second place 3, third place 1; a vote for "no award" counted 0 in all three places. The ballot was as follows:

Chicago Executive Radio Council, for the conception and staging of the first national amateur radio convention and also for their past work in conceiving, putting into practice and proving the workability of the "Chicago Plan" which has become the national standard in the conduct of citizen radio communication ..... 21 points

H. W. Castner, Portland, Maine, for his noteworthy work in the organization of the Maine region.. 7 "

C. L. Austin, Portland, Ore., for the design of the tube set used at



The Smith trophy

his station, 7XF..... 6 points  
 Boyd Phelps, Minneapolis, for a technical article entitled "Radio Below 200 Meters"..... 6 "  
 L. C. Young, Naval Air Station, Anacostia, D.C., for his persistence and operating skill which contributed to a large extent in the fine performance of station NSF, the first powerful short-wave C.W. station..... 5 "  
 L. A. Kern, Univ. of Michigan, for the organization of a radio press service ..... 3 "  
 J. K. Hewitt, Brooklyn, for the first definitely established trans-continental amateur tube work, between station 2FP, installed by him, and station 6ALE at Reedley, Cal. .... 3 "  
 H. J. Tyzzer, Medford, Mass., for the design of various Amrad specialties ..... 3 "  
 J. L. Reinartz, So. Manchester, Conn., for the origination of the Reinartz C.W. Tuner..... 3 "  
 E. R. Bateman, Baltimore, for organization work in the Baltimore metropolitan district..... 1 "  
 H. H. Lyon, Washington, for operating skill and station performance as evidenced by the concerts sent from station WJH, formerly 3NR ..... 1 "  
 There were no votes for ten other candidates.

By an overwhelming vote, then, the Smith Trophy, carrying with it the honor of recognition of substantial contribution to the game, goes to the hard-working Chicago gang who first demonstrated their co-operative ability in the formation of the justly-famous "Chicago Plan" for the division of working hours and who put across the First A.R.R.L. National Convention in Chicago last September. Chairman Kruse, in reporting for his committee, says:

"The distribution of the members, unanimous nature of the vote, and general satisfaction expressed at the result, as-

sure me that the cup has been well awarded and that it is not the mere expression of a small group that the Chicago Executive Radio Council has done the outstanding deed in favor of citizen radio which Mr.



Mr. Seymour Wemyss Smith

Smith had in mind when presenting us with the cup. It is my very real pleasure, therefore, to report that in awarding to the Chicago Executive Radio Council the Seymour Wemyss Smith Cup for distinctive achievement in Citizen Radio we express not merely the opinion of nine men but the opinion of the American Amateur who is the American Radio Relay League."

We heartily second the motion! Three big cheers for the Chicago Council!

## The Second District Convention and Show

EVERY attendance record for radio conventions and shows went to smash at the second annual affair of the Second District Executive Radio Council, held in New York on March 7th to 11th at the Hotel Pennsylvania. Over forty thousand people attended the show in the five days, with an average of four thousand on the floor all the time, and literally thousands were turned away because there wasn't room for them to get in. Over sixty exhibitors were

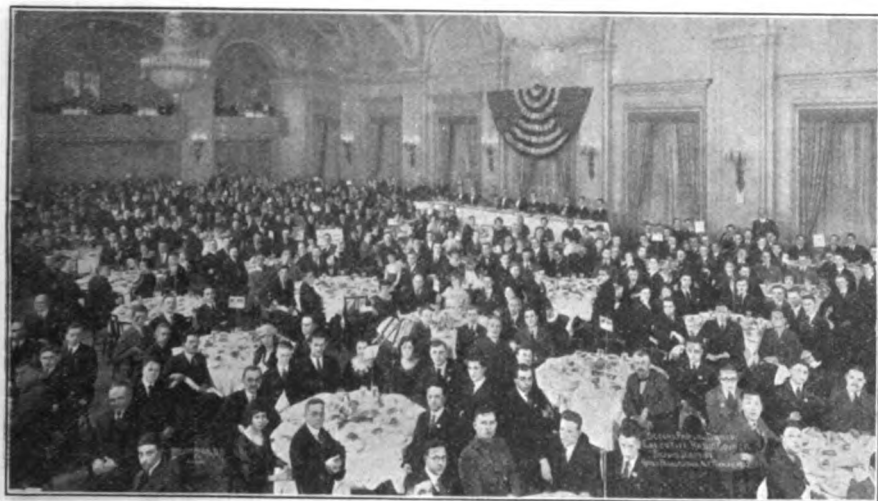
in charge of their respective booths, the show this year occupying the entire Butterfly Room in addition to the Roof Garden—and next year it looks like they will need Central Park to accommodate the gang.

One of the most important things that came out of this stupendous affair was the establishment of a better understanding between the new-comer listeners and the old-time amateurs. It is an undisputed fact that this actually happened. The public met the amateur and liked him. The ama-

teur was everywhere and he knew all about everything and could explain it. His jargon of technical talk completely caught the fancy of the members of the general public, and the New York papers in their accounts of the affair and their cartoons reflected not the viewpoint of the rather unhappy novice listener but the spirit of the real amateur! This to our surprise, for

formed the conclusion that it consisted of the amateurs plus their fathers and mothers and uncles and aunts and cousins and grandparents—and that means that it was still an amateur crowd.

The show was officially opened at 8 p.m. on the 7th with approximately three thousand people present. Various demonstrations were given, including that of E.

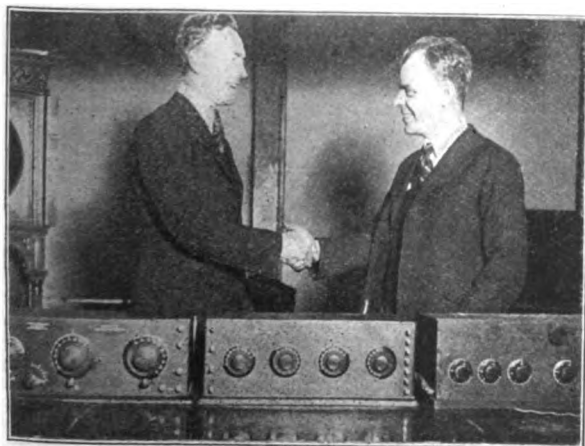


The Banquet at the Pennsylvania Hotel

we had feared the amateur would be swamped at this Show. And the banquet! Man, dear, there were only eleven hundred folks present, and who do you reckon they were? It was an amateur gang in its sympathy and spirit, almost entirely so, and looking around the big ball-room we

D. Glavin's wireless-controlled automobile, which particularly delighted the crowds. On the following days the show opened at 2 p.m. with various meetings held in the big ballroom of the hotel. On the evening of the second day Mr. W. C. White of the General Electric Company gave a very interesting talk on "Vacuum Tubes and Their Operation" and Paul Godley described further his experiences in Scotland during the A.R.R.L. Transatlantic Tests in December. By courtesy of one of the large electrical corporations, movies of what happens in a vacuum tube were shown.

One of the interesting events of the Convention was the code speed contest. This was won by Mr. Jose M. Seron, a receiving operator of the Radio Corporation of American whose home is at Mamaroneck, N. Y. He attained a speed of 49.5 words a minute with only three errors. Mr. B. G. Seutter, last year's winner, copied at the same speed but with four errors. Mr. Seutter's record of last year was 48.6 words per minute with two errors. A code speed contest was also held for women,



At the Show—Paul F. Godley of Transatlantic fame and Jack Binns, here on the first S.O.S. Photo by Keystone View Co.

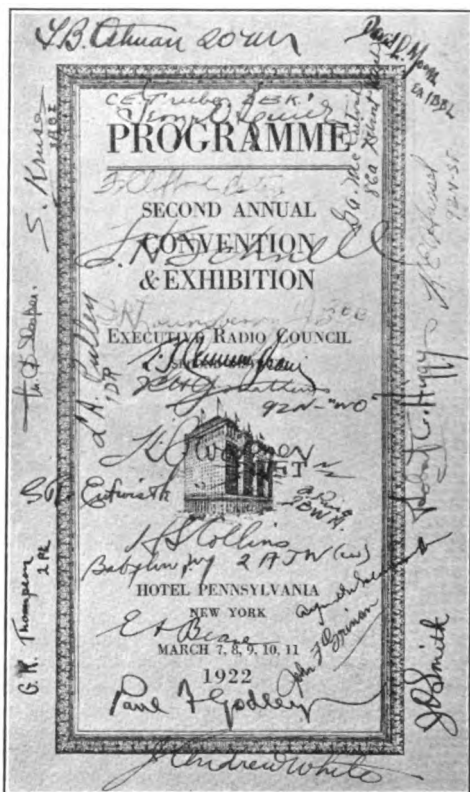
Miss Ruby Yelland winning with a speed of 30.5 words per minute with perfect copy. Her closest competitor was Miss Marianna Olive Chicken with a speed of 30 words per minute, with Miss Marian Brown third, same speed.

In the Butterfly and Roof Garden there always was a big crowd viewing the exhibits and the amateurs were completely swamped by the vast number of people who came to see the latest developments in the radio art more out of curiosity than anything else. As many people attended in one day as did during the whole convention last year.

Really new features and designs of apparatus were badly lacking, due probably to the enormous demand for equipment already on the market not allowing the manufacturers a chance to make new designs and start their manufacture. QST will publish description and photographs of the few new pieces of apparatus that were displayed, in an early issue.

The foremost event of the Convention was the radio banquet to which every radio man looked forward as a happening of much importance. On the evening of the last day 1100 people gathered in the main banquet room of the hotel for what was undoubtedly the largest radio banquet ever held. After a few words from Chairman J. O. Smith, everybody fell to and stuffed themselves while entertainment was furnished by many of the artists that have given the programs from WJZ and WDY. After the eats were stowed away, Chairman Smith introduced the various members of the Convention committee and complimented them on their work. A roll call by districts was then called and representatives found present from all districts except the sixth and seventh. The first speaker of the evening, Mr. John V. L. Hogan, of the Westinghouse Electric and Manufacturing Company was called upon and he discussed the relation of the amateur to the manufacturer, mentioning that the amateur was the manufacturer's most important asset. Following Mr. Hogan General Squier, Chief Signal Officer of the Army, was introduced and given a hearty cheer. Lieut. Commander D. C. Patterson was next on the program and gave a short discussion of the history of the radio in the navy, making it impressive that the amateur should not forsake the telegraph for the telephone. Mr. David Sarnoff, Commercial Manager of the Radio Corporation of America, then followed and discussed the policy of the Radio Corporation of America and their policies toward the amateur. He mentioned that it would be proper to talk of many amateurs as commercials and many of the commercials as amateurs when accomplishing results was taken into consideration. Major Roy H. Coles, Chief Signal Officer of the Second

Corps Area of the Army which includes the second inspection district of the Department of Commerce, was the next speaker and discussed army radio in general and the great problem of getting operators in time of need. He complimented the second district amateurs on their operation and expressed his desire to have them cooperate with the Army. Next in order was a roll-call of the well known amateurs of the second district which was ac-



A popular habit at Conventions—autographed program as a souvenir

companied with much enthusiastic applause. At the conclusion of the roll-call the trophies were presented to the winners of the various code contests. The next speaker on the program was Arthur Batcheller, Chief Radio Inspector of the Second District, but who unfortunately could not be present, being in Washington at the time. He was represented by H. L. Bogardus, assistant inspector. Dr. A. N. Goldsmith then told of the work of the recent radio conference in Washington of which he was a member, representing the Institute of Radio Engineers. Next in order came the roll-call of all the clubs affiliated with the

(Concluded on page 48)

## More About the Transatlantics

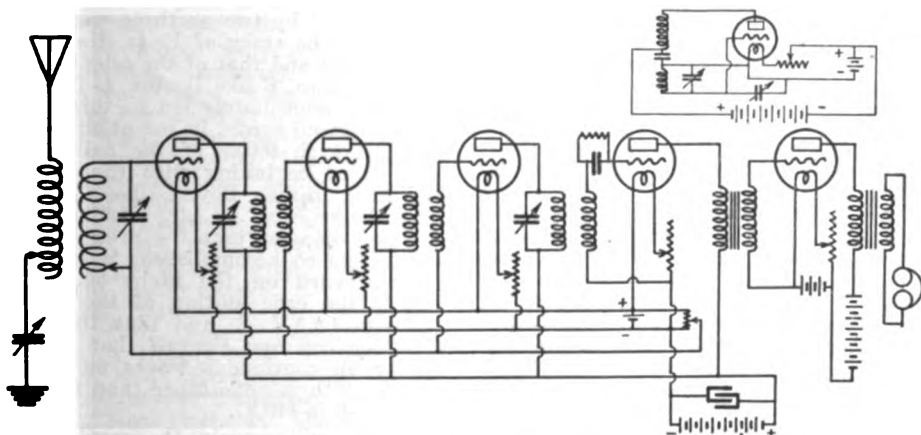
**I**N our last issue we mentioned some of the results of our recent Transatlantic tests by the English amateurs. Complete information was not available at the time of the above writing and it since develops that some of the statements therein were incomplete.

We are indebted to the "Wireless World" for further information and an accurate report from the British amateurs. The following stations were heard and correct code words copied: 1AFV, 1ZE, 2BML, 2FP, 2ZL. The following were heard during the free periods: 1BCG, 1UN, 1RU, 1XM, 2ZC.

steps of audio-frequency amplification. Ediswan ES-4 valves were used for the high frequency amplifiers and a Mullard "Ora" for the separate heterodyne.

Mr. Burne's antenna consisted of an inverted L type of two wires supported by a mast in the garden and one on the house, being 56 and 46 feet high respectively. The aerial is within the G.P.O. limits (a total length of wire, 140 feet) being 45 feet long and having a downlead of 50 feet.

The radio-frequency transformers are particularly interesting and are of the semi-tuned type. The transformer "for-



Mr. Burne's Circuit Arrangement

In England there were prizes offered for the best reception and Mr. W. R. Burne of Sale, Cheshire, was the first prize winner, Mr. H. H. Whitfield, of Birmingham, second prize; while Mr. W. E. F. Corsham of London and Mr. R. D. Spence of Aberdeenshire were joint third prize winners.

The apparatus used by the English amateurs was quite different from that in general use in this country. Some rather unusual outfits were constructed especially for the tests and we refer our readers to the February 4th and February 18th issues of the "Wireless World" wherein a complete and detailed description of the successful receivers was given.

The apparatus of Mr. W. R. Burne is of particular interest inasmuch as he heard seven different stations. We are reproducing a circuit diagram of his apparatus showing three steps of radio frequency amplification, detector and one stage of audio amplification. During the tests from three to six radio frequency valves were used with an occasional addition of one or two

mers" were turned out of solid 1¼-inch ebonite rod, a groove ¼th of an inch deep containing the primary and secondary windings consisting of 30 and 35 turns of No. 38 D.S.C. copper wire, the secondary wound over the primary. These transformers were good for 180 to 325 meters with the shunted variable condensers made for the occasion.

The second prize winner, Mr. H. H. Whitfield, who heard 1AFV, 1BCG, and 2ZL, had a particularly interesting arrangement which contained some rather unusually constructed apparatus. His receiver used two steps of radio-frequency amplification, a detector and two steps of audio amplification. A three-coil tuner with single layer coils was used with long wooden handles to vary their couplings. All of his apparatus was homemade and especially for the occasion.

Mr. Corsham of London, joint third prize winner, used a detector and two steps of audio amplification, being very similar to the arrangements in general use in this country. Mr. R. D. Spence, the other third

prize winner, used three steps of transformer-coupled radio-frequency amplification, a detector and two audio amplifiers.

The apparatus of Mr. J. R. Forshaw, also a prize winner, consisted of one step of radio-frequency amplification, a crystal detector and one step of audio-frequency amplification. 1BCG was heard by Mr. Forshaw and he reports fading signals when a steam train passed by his house which he attributes to the cloud of steam and smoke emitted from the engine.

The English amateurs are certainly to be complimented on their fine work and we only hope that they will now be able to hear American signals frequently and in the very near future that we may be in direct communication with them.

#### Interest in France

THE French amateurs took an intense interest in the tests, copying each morning Mr. Godley's daily reports of the results of his listening, creating what Dr. Pierre Corrot, editor of their amateur magazine "La T.S.F. Moderne", calls "a most palpitating romance". Their only information was second-hand and they were rather hard put to it to make heads or tails of the cryptic radiograms they copied from MUU. Thus we find them wondering what in the world a "Beverage" antenna might be, their dictionary saying that a "beverage" means "a drink" or a "potation".

In Godley's second telegram, his statement "Heard one able yacht during free for all period sinkgap fading" completely got their animal. Quoting Dr. Corrot, "...a most remarkable sentence. It appears that Mr. Godley heard very well indeed during the open-all period accomplished or able yacht! He therefore heard nothing from America. It is not astonishing under the prevailing atmospheric conditions."

Two days later Godley had reported 1BCG. "This time here we are! A warm rain is falling; the wind has calmed and the atmospheric have diminished in intensity. And Mr. Godley has heard one boy cast George who called him on continuous waves.... But who might be this "Boy throws George" who confirms the success of the transatlantic test? What a peculiar language Mr. Godley talks!"

And then, fellows, do you remember Godley's long message, the one with the thrill:

"One London—TC—American Radio Relay League Hartford Conn U.S.A.—  
Heard one ram unit two fox pup two boy mike love stop Code words of these three verified Coursey stop Also heard cables from following spark one able ram yacht one boy dog tare two boy king two dog ran three boy pup also following contin wave on able ram yacht one boy cast george one boy dog tare one boy george fox one yacht king one xray mike two fox

*dog two easy have eight able cast fox eight xray vice stop Strong and reliable—Godley".*

Dr. Corrot continues: "Here is a puzzle for us! A correspondent writes us: 'I'll be damned if I understand anything of this mystery where rams, dogs, foxes, yachts and even X-rays play such an important part!!! Might this not be a code?'"

"Yes, it is one! Let us consider the second part of this telegram. 'Code words of these three verified Coursey'. This shows us that the preceding sentence treats of the transmission of three American amateurs, pre-arranged words transmitted by whom have been verified by Mr. Coursey. And if we remember that the calls of the American amateurs are all issued with a number followed by two or three letters; if we notice that in the first sentence there are exactly three numbers (1, 2, 2) each one followed by two or three words; if we remember the story of Fritz, Karl, Walter & Company and that of the telephone girls, 'A like Andre, B like Bertha, C like Cecily'—we are immediately led to think that in order to avoid errors in reception they have replaced each letter of the calls received by a word beginning with that letter: A like Able, B like Boy, C like Cat, D like Dog, E like Easy.... etc. And now all at once we discover that the pretended yacht which was so accomplished, 'one able able yacht', heard on the night of December 8th, is the code station of the American amateur 1AAY... and that the remarkable 'one boy cast George' that called Mr. Godley on continuous waves on the night of Dec. 10th is none other than the station whose call is 1BCG.

"There still remain the words 'sinkgap fading' which are most incomprehensible even when we know that 'sinkgap' is an abbreviation for synchronous rotary spark gap. It just confirms in us once more the idea of an international language which exists and which is used with success, and which is the necessary complement to radio telegraphy and even more so to radio telephony. What good do the words we receive do us if we do not understand them?"

"The puzzle-telegram of Dec. 12th reveals to us in its turn that on the memorable night of the 10th and 11th the following were heard: 1RU, 2FP, and 2BML, whose code words were verified by Mr. Coursey, also the calls (cables is certainly a mistake; Mr. Godley must have written calls, perhaps not very legibly) of 1ARY, 1BDT, 2BK, 2DN, and 3BP, and finally the C.W. stations 1ARY, 1BCG, 1BDT, 1BGF, 1YK, 1XM, 2FP, 2FD, 2EH, 8ACF and 8XV, eighteen stations heard on the same night (strong and well) of which one, 1BCG, was heard the night before and two, 1ARY and 1BDT, were heard on spark and on C.W."

(Continued on page 39)

# EDITORIALS

## de AMERICAN RADIO RELAY LEAGUE



### The New A.R.R.L. Board

**A**S our members all noted, the A.R.R.L. had an election of a new Board of Direction for the two-year period beginning on the third Saturday in February. Ballots were circulated in middle January and every member of the League had the opportunity of helping choose our governing body for the next term.

Twenty-two names were on the ballot, and the seventeen receiving the highest numbers of votes were to be elected. The returns were canvassed at the Board meeting held at Washington on Feb. 18th, during the Third-Fourth District Convention, and it was found that the membership had elected the following men for the new body: Harvey Mitchell Anthony, of Muncie, Ind.; H. A. Beale, Jr., 3ZO, Parkesburg, Pa.; A. E. Bessey, 6ZK, Sunnyvale, Cal.; V. F. Camp, 2RL, Brightwaters, L. I.; F. M. Corlett, 5ZC, Dallas; C. E. Darr, 8ZZ, Detroit; W. C. C. Duncan, Canadian 9AW, Toronto; A. A. Hebert, 2MP, Nutley, N. J.; F. A. Hill, 4GL, Savannah; Dr. A. E. Kennelly, of Harvard University; S. Kruse, Cambridge, Mass.; H. P. Maxim, 1AW, Hartford; F. H. Schnell, Hartford; C. A. Service, Jr., 3ZA, Bala, Pa.; C. H. Stewart, 3ZS, St. David's Pa.; K. B. Warner, Hartford; and M. B. West, 9DEA, Waukegan, Ill.

Dr. Kennelly and Messrs. Beale, Darr, Duncan, and Hill will be new faces on the Board, the remainder being re-elected from the previous board. Good men all, we feel, and we are particularly pleased to have a Canadian amateur sitting at the big table. We hope that Canadian amateurs will keep him posted on ways in which the League can help them.

After the new Board had been installed it proceeded to elect new A.R.R.L. officers for the two-year period. Hiram Percy Maxim, founder of the League and our pilot thru all the torturous years of our childhood as an organization, was unanimously returned to the chair as our President. Similarly we have Mr. Hebert continuing as Treasurer (and a very good one he is), Schnell our Traffic Manager, and Warner as the hard-working Secretary, while Mr. Stewart, a real old-timer and our best advisor in legislative matters, becomes

our new Vice-President, succeeding Mr. Service, who declined the nomination.

These are the men that you have chosen to steer our ship of state for the next two years. They will do their best to serve you.

### Amateur Self-Policing

**O**NE of the dreams of our A.R.R.L. now bids fair to become true very soon.

It is that we may be permitted to police ourselves by means of representatives chosen from the midst of us amateurs and deputized to act as assistant radio inspectors with enough authority to insure respect of their orders.

Of course for a long time we have had our local traffic managers, our co-operative rules and our division of operating hours—ever since there was a "Chicago Plan"—and the local radio inspectors have given us hearty co-operation and as much of their time as they could spare. But there has been a lack of authority and our executive councils and division officials have not always been able to back up their demands for good behavior when meeting up with the occasional refractory individual who lacks respect for the laws and the rights of others.

Secretary Hoover tells us that he is looking to us amateurs to take care of ourselves. He knows full well that we have been doing it pretty successfully right along, but there will be more of us and in particular a big inspection problem will come about when we start subdivision of the amateur band for the various types of our transmitters. The worst punk can see that the hope of benefit in the new system depends upon its rigid observance. Secretary Hoover says we must do that job ourselves, and so our A.R.R.L. has asked that provisions be made for Amateur Deputy Inspectors, and the Radio Commission now sitting in Washington has approved the idea, as is reported in our leading article in this issue. The deputy inspectors would be elected by all the amateurs in a community, and of course that means that the local affiliated clubs will be the logical places for getting together and selecting the men.

The adoption of the plan is not yet assured but with the Department of Commerce proposing it, we amateurs ourselves wanting it, and the Commission recom-



mending it, we can expect it soon. We will have more to say about it then. Meanwhile think it over, fellows.

## A Word to the Novice

**W**E have a new term in radio nomenclature: *novice*, meaning one of the beginners in the fascinating game of wireless attracted by the phone broadcasts, as distinguished from the old-time *amateur*. We don't know who started the use of the word *novice*, and both classes of course are really *amateur*, but a differentiating word is a good thing to have and it will do as well as any.

This then is a word to the novice. There are a few hundred thousands of you now, and there will be millions shortly. To all of you these lines are addressed.

Won't you let us amateurs help you? We'll be glad to. We went thru the mill ourselves, you know—every one of us—and we know exactly what you are up against. Forgive us if sometimes we cannot repress a smile at some of your stunts. We do not grin in unkindness—we're only recalling the days when we used to try all the trick circuits we could hear of, when we used to ask a million questions, when we used to scratch our heads to figure out where this old telephone ringer or that old spark coil could be used to bring in better signals: the days when we used to be thrilled thru and thru at hearing a single signal!

We all agree that it is the most fascinating game that ever happened, don't we? We've fought it all out, you know, we amateurs, until today honestly we believe we are crackerjacks at short-wave reception. We've tried about everything under the sun and now we know just how to build our tuners and our amplifiers and how to adjust them to get the best operation out of them. We'll be glad to help you in exactly the same way. We have radio clubs in every town and we want you to feel welcome to come around and get acquainted. We regard you as much a regular fellow as ourselves, and we'll be darned glad to have you in with us!

We amateurs have transmitting stations too, most of us. And we are able to work perfectly amazing distances by dot-and-dash telegraphy, talking to each other often over distances of a thousand miles. In our American Radio Relay League we have a network of air lanes covering the entire country, and every night we handle hundreds of free messages for the sport of it, passing them on to the next fellow in the proper direction. Last month we had a definite record of 30,000 messages handled. This is a big business and it's valuable training, and we have a wonderful co-operative machine built up to make it possible.

We would like for you to know when you hear our dots and dashes that it isn't "the American small boy" playing around, but an organization of thousands of young men who are about a more or less serious business, engaged in mastering a complex art. With our amateur transmitters we have sent a friendly message from the Atlantic Coast to the Pacific and got the answer back to the Atlantic in a total of six and a half minutes! We conveyed messages from the governors of the individual states to President Harding over our traffic system in early March. For months we lent our services to the Bureau of Standards and helped in the collection of a world of data on the cause of the mysterious fading-out of signals. And recently we carried on tests with amateurs in England and nearly three dozen of our stations were heard over there! Really we are doing things, and in doing them we are advancing the art and keeping ourselves ready to serve our country again as operators if ever again we are needed.

We've been at this for fifteen years, and that experience is yours for the asking. Wireless isn't all success, and we can give a lift in the bad places. Radio hasn't been near perfected yet, and it's still subject to interference from a dozen sources. Leaky electric light lines make a noise like a spark set holding down the key and frequently will prevent any of us in an entire city from hearing a thing for night after night. Elevators, X-ray machines in hospitals, violet-ray machines, welding machinery—dozens of such devices—make a horrible clatter on the air. The transmitters on ships and commercial and government stations sometimes get out of adjustment and put a smother all over the tuner. We amateurs have been blamed for most of this, and to our certain knowledge in case after case where it wasn't an amateur transmitter at all. Please be fair to us, won't you?

Do you know that some of the receiving tuners being marketed today are not worth a damn, in our humble opinion? The manufacturers make them simple in the mistaken belief that you can't operate a real modern tuner. We threw them away years ago because they won't tune sharply enough to do us any good. Yes, we mean to say that they are a relic of by-gone days, and yet they are being made today by the hundreds of thousands for listening to concerts. Do you realize that there are 15,000 of us amateurs transmitting, with most of us crowded together near 200 meters? It's about as if there were 15,000 telephone broadcasting stations working at the same time at that place on your tuner where you get the music. Say, wouldn't you have a sweet time trying to hear the one you wanted? We had to grow away from these kind of instruments in order to pick out



our man from the thousands of others, and we use loosely-coupled tuners that have selectivity in order to do this. They are not hard to learn to operate, in spite of rumors to the contrary, and the results are surely worth the trouble even if they were. Of course you hear local amateurs on such tuners as you use—we'd hear our whole gang if we tried them for our amateur reception, and we'd get nowhere. But we know from our experience that if you'll get a selective tuner you will very rarely hear an amateur or a ship, unless you tune for them, and you'll get the broadcasts even better too.

And some day we fear this listening business will begin to pall. You'll want to transmit. There's room for you, Old Man, and when you come to the place where you want to climb in with the rest of us in the dot-and-dash transmitting business you'll be a regular amateur and will find our gang waiting for you.

To make a long story short, here's the helping hand of the American Radio Relay League, our national amateur organization!

### Funds For Inspection Service

**I**T is now practically assured that the Inspection Service of the Department of Commerce will have adequate funds for carrying on its activities. The shameful way in which this branch of the government has been restricted financially in the past thru petty politics is well known to all of us amateurs. But for the fiscal year 1923 \$80,000 was asked for enforcing the radio communication laws and, in addition, on March 3d Director Dawes, of the Bureau of the Budget, recommended another \$50,000, pointing out that in the past two months there has been a tremendous development in the radio field, particularly in broadcasting, with some 600,000 listening-in stations now to be served and safeguarded. As Secretary Hoover states, "The interference caused by these broadcasting stations with each other and with the regular use of radio communication both in connection with safety to life at sea and for commercial purposes has been followed by demands from all sections of the country that immediate steps be taken to remedy a condition which is rendering this popular and important use of wireless impossible. Our present force is entirely insufficient to cope with this emergency."

When General Dawes, the man who has slashed the dickens out of almost every request for appropriations, recommends still more money for the enforcement of the radio laws, it is safe to say it will be forthcoming. President Harding approved the request and sent it to Congress the same day, and it is understood that there is no question but that our Inspection Service will now come into its own. The additional

\$50,000, it is contemplated, will provide an additional assistant radio inspector and another radio clerk in each of the district offices. Hurray!

We of the A.R.R.L. can take a little of the credit for this increased appropriation. Our League has been working in this direction for many months, and we can feel that we helped to bring about the improvement.

### MORE ABOUT THE TRANSATLANTICS

*(Continued from page 36)*

Good for the Frenchmen! They figured it out exactly right, and give them credit, fellows. They will be good chaps to work with when international amateur radio becomes a commonplace. And, by the way, it gives us great pleasure to record that, possibly largely as a result of our own A.R.R.L. Transatlantic Tests, the bars have been let down in France and amateurs there are being licensed to use 200 meters and 100 watts of C.W. Soon we hope that they, like the British, will be ready to test to us and give us the privilege of repaying them for their kindness in listening for our signals.

Once having discovered the "system", "La T.S.F. Moderne" had no more trouble and proceeded in its article to interpret the succeeding Godley messages with difficulty. When Mr. Coursey let it be known that American stations were heard as well by the British amateurs, they said: "Bravo, British Amateurs! You have shown that without special installations Old Europe in spite of its hindrances can show itself to the haughtiness of Young America."

Dr. Corrot considers that the tests were a very valuable contribution to the art from a viewpoint as yet little known. "The short wave lengths, it was said, would not carry! Well, you see, they do carry. There now remains an indisputable fact whose explanation is yet to be found. Our sincere scientists do not hide their astonishment. These results, they say, are truly surprising; to cover more than 6000 kilometers with wave lengths of the order of 300 meters and with a power of about a kilowatt! It seems to them most difficult to find an explanation even somewhat satisfactory in the light of the knowledge which we possess on the propagation of waves. Perhaps, they say, we should think about the reflection of the waves from the higher strata of the atmosphere. In any case it would be premature to take up a position before more complete experiments and study may be made. Other formulae in hand show that this had to come and that it could not have been otherwise. Wave lengths of 200 meters would be, all in all, more preferable than those of 800 to 1000 meters.

"Meanwhile let us not exaggerate for it is a far cry from these experiments to a

*(Continued on page 54)*

# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



**H**OW many of you fellows in the Operating Department realize that 245 men represent the small number of good, live, snappy leaders who keep our ball of relay traffic rolling? How many of you take a bonafide interest in reporting activities of A.R.R.L. members in your section? Why should the number of live wires be limited? It should not be limited, therefore we are going to make room for about 500 more men. Now we are not interested in dead timber! We want and insist upon having the very best material we can find. We shall accept

office with the prefix of assistant except that of the Assistant Division Manager.

The report of activities of the Operating Department will be confined to relay routes and traffic handled. Primarily, the purpose of the A.R.R.L. is the relaying of friendly messages without charge. And they must be **DELIVERED**. Each division will be allotted a certain amount of space in QST every month for its report and that space will be determined by the actual number of amateurs in each division and the amount of traffic handled. Such reports will be compiled by the Division Manager

## Message Traffic Report By Divisions

### FEBRUARY

| DIVISION                          | C.W.       |             |           | SPARK      |              |           | TOTAL      |              |           |
|-----------------------------------|------------|-------------|-----------|------------|--------------|-----------|------------|--------------|-----------|
|                                   | Stns.      | Mgs.        | MPS       | Stns.      | Mgs.         | MPS       | Stns.      | Mgs.         | MPS       |
| Atlantic                          | 49         | 2529        | 52        | 25         | 1643         | 66        | 74         | 4172         | 63        |
| Dakota                            | 8          | 269         | 34        | 26         | 2443         | 94        | 34         | 2712         | 80        |
| Delta                             | 6          | 297         | 50        | 10         | 1253         | 125       | 16         | 1550         | 97        |
| East Gulf                         | 9          | 616         | 68        | 11         | 542          | 49        | 20         | 1158         | 58        |
| Midwest                           | 8          | 362         | 43        | 12         | 940          | 78        | 20         | 1302         | 65        |
| New England                       | 2          | 92          | 46        | 10         | 956          | 96        | 12         | 1048         | 87        |
| Norwestern                        | 2          | 41          | 22        | 18         | 1006         | 56        | 20         | 1047         | 52        |
| Ontario                           | 1          | 24          | 24        | 3          | 99           | 33        | 4          | 123          | 31        |
| Pacific                           | 6          | 332         | 55        | 11         | 1572         | 143       | 17         | 1904         | 112       |
| West Gulf                         | 7          | 94          | 13        | 36         | 3080         | 86        | 43         | 3174         | 74        |
| Roanoke                           | 12         | 349         | 29        | 11         | 222          | 20        | 23         | 571          | 25        |
| <b>Total</b>                      | <b>110</b> | <b>5005</b> | <b>45</b> | <b>173</b> | <b>13756</b> | <b>80</b> | <b>283</b> | <b>18761</b> | <b>67</b> |
| Total Messages, Spark, 13756, 74% |            |             |           |            |              |           |            |              |           |
| Total Messages, C.W., 5005, 26%   |            |             |           |            |              |           |            |              |           |

applications from everyone and the best men will be selected for the various departments. The reason for this is the fact that the entire Operating Department is being overhauled. When we get through overhauling it we will have the organization so perfected that it will function under all conditions not barring even static.

The present scheme will provide for 18 Division Managers; 48 to 60 Assistant Division Managers (one for each state); 300 to 500 District Superintendents depending, upon location; (the office of Assistant District Superintendents will be discontinued) 100 to 300 City Managers; and all other titles will be discontinued being absorbed by men appointed to some one of the above offices. There will be no

or his appointee and must contain nothing but interesting facts concerning routes and traffic handled. Special mention of good work will be made when necessary to bring out such work. No individual report of messages handled will be made in the division reports, but the complete summary for each division will be shown each month with the station handling the greatest amount of messages honored as in the past. What we want is team-work or co-operation, not individual glory hunting. We want every man to work as part of his divisional machinery in order to make the division stand out prominently in relay affairs of the League.

The Dakota Division walks off with first honors this month and it looks like 600

messages or more are necessary to cop the prize.

\*\*\*\*\*  
**YANKTON COLLEGE, 9YAK**  
 \*\*\*\*\*

Yankton, S. D.

604 Messages

Dakota Division

\*\*\*\*\*  
**MID-WEST DIVISION**  
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L. A. Benson, Mgr.

**DISTRICT OF IOWA, P. A. Stover,**  
 Asst. Div. Mgr.: The following appointments are made for the State of Iowa to take effect immediately:

Asst. Division Manager: P. A. Stover, 9YA, 213 E. Market St., Iowa City, Iowa. District Supt.: D. R. Watts, 9ARZ, Clear Lake, Iowa. Supt. of Routes: K. R. Bloomer, 9KQ, 430 Harrison St., Burlington, Iowa. City Mgr. Des Moines: A. J. Tingley, 9DEH, 829 E. 28th St., City Mgr. Davenport: R. W. Sears, 1012 High St., 9MS. City Mgr. Clinton: D. I. Bailey, 525 Kenlworth Court, 9CS.

The Asst. Div. Mgr. reserves the right to cancel any of the above appointments if at any time the duties of the officer are not properly carried out. City managers are needed for the following cities: Cedar Rapids, Council Bluffs, and Muscatine. Make applications to Asst. Div. Mgr. All station operators in the state are requested to mail a card to the Asst. Div. Mgr. before the fifteenth of each month stating the number of msgs handled and other information of value. All stations that report will be given due recognition in the district report.

The following routes are working satisfactorily: #1, 9ZA, 9BAP, 9DOF, 9ARZ, 9YAE, 9ZU. #2, 9CS, 9ACN, 9YA, 9DRA, 9AMU, 9JN or 9YI, 900 or 9AUX, 9DBS. #3, 9AWX or 9UG or 9MS, 9ACN, 9YA, 9DRA, 9DEH or 9IY or 9OA, 9DJX, 9AEQ, 9HT. #4, 9KQ, 9PL, 9ABY, 9YO, 9AEQ, 9HT. #5, 9ARZ, 9DOF, 9YI or 9JN, 9IY or 9DEH or 9OA, 9YO. #6, 9ZA, 9DVO, 9YA, 9ACN, 9OZ, 9SL. If you want on these routes write us stating your qualifications.

9ACN is proving a valuable station on routes #3 and #2. 9FK and 9CS are high men in their section. 9AEQ gives us the following: 9DMB is on again and is proving an ideal relay station. 9XAJ at Bedford is working on 425 now and will QSR at any time. 9AEQ is changing to CW and with two fifty watters. 9MS and 9AWX roar in and are on almost any time after eleven; we have no msg report from them. 9ZU is coming into his own again and is working both spark and CW. 9YAE is helping to keep that district clear also and is doing some remarkable DX work. They maintain a constant watch, this being made

possible by having five good operators to draw from. Among the CW boys that are keeping the air hot are 9DOF, 9BAP, 9AMU and 9JN. Most of these installations are ten watt and on less than 200 meters. 9DEH, 9IY and 9OA are putting Des Moines on the map and between them they keep the city open every night.

**DISTRICT OF KANSAS, F. M. Ende,**  
 A.D.M. Fort Riley, Kansas: The new A.D.M. assumed the duties of that office just twelve days prior to the date of this report with the consequence that the data at hand is incomplete.

Hutchinson is a hot spot for relay west and exceptionally business-like work has been done by 9DSD, 9DUG, 9ALU, and 9ALV.

9ALU is always QRV between 2 and 4 A.M. being unable to carry on much traffic before this hour because of blinking all the lights with his spark set. (Get on the C.W. band-wagon O.M.) 9AUG did such good work in December that his performance was commented on in the report for Missouri and he continues to be a very consistent station. He is an invaluable link in the low power "dalite" C.W. route extending across the northern part of the state:—9ASD, 9DVB, and 9DTA to 9AOG to 9BOW and 9ZE. *Wanted, a C.W. station in Western Kansas to hook up to 9BOW.*

While Kansas is an exceptional locality for transmission and reception, the QRN season is more violent than in any other state in which the writer has used a receiver. Anticipating this, the Route Manager has adopted the policy of moving traffic by short jumps (C.W. preferred) to collecting stations situated close to the more powerful DX stations which will operate on schedule. Traffic will move "dalite" to collecting stations a few miles from DX stations and just before schedule time will be given to them en mass. 9DZE and 9PS will keep Wichita open almost constantly while 9RV and 9BOA will do the same in Emporia with 9DTS at Ottawa acting as collecting station with three operators accepting traffic at noon and from 7 to 10:30 P.M.

**New appointments:—**

Route Manager, 9PS, Ray Youngmeyer; City Mgr., Wichita, 9PS, Ray Youngmeyer; City Mgr., Emporia, 9RV, F. A. Miller; City Mgr., Lawrence, 9AOG, C. Himoe; City Mgr., Hutchinson, 9DSD, P. Wiley; City Mgr., Glasco and vicinity, 9AEY, E. Beardmore.

**MISSOURI, G. S. Turner, A.D.M.:—**  
 Radio activity is due for a big boom in this state because of the new and very competent officers who have just been appointed. Plenty of things are happening down here in the Middle West and really this state is not as dead as some people imagine it to be.



Manager of Trenton. V. J. Braidwood has been appointed official station for Wildwood, Cape May and vicinity. Traffic stations doing good relay work are 3FP, 3BA, 3FB, 3BFU, and 3NB.

Brooklyn stations reporting last month are 2TS, 2BQU, 2AGC, 2RM, 2WB and 2PF. (Need a little help in Brooklyn so some stations will not be closed up—T.M.)

In the Hudson Valley District we find our good old reliables on the job every night with three new stations—2CE, 2ARK and 2NS. Of the old timers we find 2BM, 2DA, 2BB, 2AAC, and 2BK. (Who says they do not come back? It is reported that Runyon, ex-2ZS is all set with a powerful CW transmitter. We extend him our glad hand and wish him well and hope that he will make a report every month of his activities.—T.M.)

H. J. Brainard has been appointed city manager of Buffalo. 8QB has deserted the spark for CW and is reaching out F. B. 8BBK has done the same. 8BUM has worked 6XAD several times.

The most active stations in Pennsylvania are 8PN, 8AKW, 8ASB, 8QC, 8PT, 8BIL, 8AIO, 8BRL, 8LF, 3ZS, 8HR, 3AQR, 3ZO, and 3DM. Traffic to any one of these stations is sure fire delivery and they are on the job for all traffic.

Maryland has just five active stations in 3ZN, 3EM, 3AC, and 3HG, but these five can be relied upon for traffic in any direction.

L. M. Dunnam has been appointed district superintendent for the District of Columbia. No difficulty is experienced in traffic for Washington with such splendid co-operation of all stations. 3ALN has worked 6XAD several times. 3LR has been heard on the coast. 3JJ has broken into the DX column on several instances. The most prominent stations for last month were 3ZY, 3ALN, 3JJ, 3AFU, 3XL, 3AHU, 3KM, 3CI, 3ARN.

### EAST GULF DIVISION

B. W. Benning, Mgr.

Although a great deal of traffic has been handled in this Division this month, our report is a rather limited one, due to a number of the District Superintendents attending the Convention and the consequent failure of the Assistant Division Manager to receive the information necessary for the compilation of a complete report.

Bradentown, Fla.—City Manager Clough has aroused much interest by his radio demonstrations at the Midwinter Fair. West Palm Beach, Fla.—4DZ and 4BC continue to do good work (DX) on their spark sets, but no report of messages handled sent in. St. Petersburg, Fla.—4JY and 4IW, C.W., are beginning to come through. A number of new stations are being installed

thanks to the efforts of City Manager Hall who is to be complimented on his good work in organization and boosting of interest.

Jacksonville, Fla.—There are five spark sets in Jax. All need better tuning to enable them to do DX work. We shall expect City Manager Clark to get in behind these and put them in good shape! 4ZE with the best antenna in the State, reports 121 messages handled on C.W. 4BP has his spark roaring, and will handle traffic from now on. 4EZ has a good spark set.

Orlando, Fla.—4II handled 70 messages on C.W., The Dist. Supt. wishes to heartily thank the A.R.R.L. men of Florida for making it possible for him to attend the Convention as Delegate. He discovered a thousand new ideas, which he will put to good and efficient use in his organization work throughout the State.

Atlanta, Ga.—A city boasting a bunch of genuine good fellows in the radio game—and a big bunch, too. Heretofore, it has done rather mediocre work in DX work, considering the large number of stations, but which this month did such a roaring relay business that a genuine Aurora Borealis still hangs over the city. LISTEN! FIVE HUNDRED SEVENTY FIVE messages handled! They did it like this—4FT, 280 messages, C.W.; 4CG, 86 msgs, 10 C. W. and 76 spark; 4AU, 85 msgs, spark; 4YA, 15 msgs, spark; 4CO, 30 msgs, spark; 4HS, 25 msgs, spark; 4BI, 18 msgs, spark; 4EH, 10 msgs, C.W.; 4ZF, 10 msgs, C.W.; 4HW, 10 msgs, C.W.; 4GM, 6 msgs, spark. The record made by 4FT is certainly an enviable one for this section. It is true his antenna is atop one of the "skyscrapers" but for this we will hand him a large sized laurel wreath for his accomplishment.

4FT has also made some distance records, having been heard six times on the Pacific Coast and having worked a station in Boulder, Colorado. Yet we do not lose sight of the good work done by all the others; many of them working under most adverse conditions. All stations in Atlanta are heartily co-operating in keeping down local QRM, and the general efficiency in handling DX work has been increased several hundred per cent on this account. A good deal of traffic heretofore given 4GN or 4FD for Florida points is now being handled direct with Florida stations, and this service is expected to be improved to a great extent in the early future. 4EA and 4CX are helping move quite a bit of traffic that was formerly mailed over certain dead spots. The Atlanta Radio Club is now installing a set, and the schedule is that this set will be in continuous operation every night. It is being installed by Messrs. Edwards 4CG, Pigford 4BX, and Ward 4AU. You will recollect the At-

lanta bunch told us some time ago to WATCH THEM!

Athens, Ga.—The habitat of OM 4AG. This is slyly slipped in the middle of the report just to remind folks that the OM's key is covered with cob-webs at present. However, he lubricated it sufficiently to squeeze thru twelve messages this past month—all spark.

Macon, Ga.—Ah, here we see that 4DH, of LaGrange escaped with his life and attended the Convention! No wonder we received no report from him! 4GU at Macon handled 3. 4AS at Macon handled 10. 4BK handled 90 messages with that "bottle" set he put in not long ago. 4AS is installing a C.W. set—10-watts. 4JH and 4BW while having handled no messages are doing some DX work and will probably soon get in line. Mr. C. H. Humphreys is putting in a 15-watt C.W. set.

Midville, Ga.—4GU and 4FD have long handled a big bunch of spark traffic to and from Florida points. 4FD has been tinkering with C.W. lately, and while he was thus occupied 4GN managed to jam thru 100 messages with his spark while 4FD connected to the extent of an even dozen. He will come, however!

Savannah, Ga.—4GL attended the Convention, and returning to Savannah threw so much at our erstwhile industrious Dist. Supt. that he fainted dead away. Hodge is in business on Bull Street and should have been immune, but 4GL must have a nasty left. If he sends with it we know he has—that forty per. In justice to all parties concerned we cannot do better than report, verbatim, the telegram received from 4BY on the 24th inst. after the doctors brought him around.

"Hodge 124 Hill 174 Hahne aerial down. Intermittently in communication west. Otherwise no report." Which means that 4BY handled 124 messages C.W. 4GL handled 174 messages C.W.

### DELTA DIVISION

Hubert E. deBen, Acting Mgr.

All the Districts have shown exceedingly fine form and we are especially glad to note the increased activity in the Tennessee District. Supt. Hutcheson and his C.M.s deserve much credit for the good work they have been doing both in organization and traffic work.

We are pleased to announce that the Pullen Brothers, 5ZAB, Houma, Louisiana have been appointed Traffic Chiefs of the division. In the future all traffic reports should be forwarded direct to them and should be in their hands not later than the 20th of the month. The district reports follow:

ARKANSAS:— Mr. Kinsolving reports a great deal of activity prevailing through-

out his district with many new stations in operation. Hot Springs:—The amateurs there have at last put Hot Springs on the radio map in red letters. There are quite an enthusiastic number of stations with 5JB standing out as doing the "big work." 5JB has a 50-watt C.W. transmitter which raises some rumpus in the air. Arkadelphia: 5MA is doing good work with his 100-watt phone set. Conway: 5UE is treating the ether rough these days. For a new man he is exceptionally good. Morrilton: 5UC breaks out now and then and sometimes handles a clump. Why not come on more regular, UC? Little Rock: Same lineup as usual, viz: 5ZL, 5JD, 5SM, 5RO, and a couple of new ones, 5CR and 5JF. The absence from the air of 5ZL and 5JD worked havoc on our traffic total.

LOUISIANA—Houma: 5ZAB, Pullen Brothers, have proven beyond a doubt that their station is one of the most efficient and consistent in the country. An excellent example of what a good station in the hands of a couple of good ops can do. How that C.W. does carry, though! Although never having transmitted on C.W. 5ZAB has been reported over a dozen times and as result, they have threatened to make themselves heard on same. Plaquemine: 5KC, Vincent Rosso, is still knocking the ether for a goal out his way. He has made many improvements in his transmitter with the result that his sigs come in twice as loud as formerly.

Shreveport: 5ZS still works in spasms. Shreveport has now a wealth of stations but none other than ZS have succeeded in reaching over the city walls as yet. New Orleans: Much activity here with DX lineup as follows: 5XQ, 5LA, 5ZAP, 5AA. Brother Lehde gave us quite a pleasant surprise the other night when he handled six with 9ZJ with hardly a break. 5LA with his C.W. transmitter is also putting 'em over the plate.

MISSISSIPPI: University: 5YE is back on the air. It took Prof. Kennon nearly all winter to get started but judging from YE's sigs his efforts will be well compensated.

TENNESSEE: February was a record month for this district. More traffic was handled than any previous month. Knoxville: 5UU has been handling traffic in fine shape. 5WS has a 50-watt transmitter in operation and will be ready to handle traffic shortly. 5XK has disposed of his rock crusher and will replace it with a 50-watt C.W. transmitter. Chattanooga: 5MB has his 20-watt C.W. transmitter going and his signals have been reported from Buffalo, N. Y. 5AAG has opened up with a ten-watt C.W. Nashville: 5AAB, 5AAM, and 5NM, all have installed C.W. 5AAB has a 1KW with which he has been doing some good DX work. 5FV has disposed of his

spark transmitter and has gone to 50-watt C.W. on which he can be heard handling traffic any night. 5ER has gone back to the ole rock crusher having been unable to handle any traffic on his C.W. transmitter since December. Memphis: We are indebted to Mr. John C. Flippin, 5LF, for the following report: 5NZ has opened up with a 20-watt C.W. transmitter and is doing good DX work. 5KU has the best C.W. station in Memphis and is doing fine work. He has no difficulty handling traffic north. Wind Rock: 5DA is away from the set most of the time, but when he IS on we all



know it. He has handled most of his traffic on spark but promises to have his 50-watt C.W. going again soon.

### DAKOTA DIVISION

Boyd Phelps, Mgr.

9YAK, Yankton College, Yankton, S. D., has become a real relay station for east and west traffic between 9ZN and 7's in Montana. 9AIG at Sioux Falls, S. D., is a reliable station for traffic in all directions but a great deal of his business comes thru 9AMB and Canadian 4CB. 9EA at Duluth deserves a great deal of credit in putting his city on the map and in working the Twin Cities regularly over territory heretofore unworkable.

Especial mention is due the stations on the Emergency Traffic Route who established communication during storm conditions when all of the land lines were down. A detailed report of this route appears elsewhere in QST.

### ONTARIO DIVISION

A. H. K. Russell, Mgr.

The past month has been excellent for wireless work, but the broadcasting programmes have cast rather a damper over the relaying of messages.

No reports have been received from Districts Nos. 1 and 2, 4 or 6. The Division Manager would drop dead if he ever got all the Districts to report in one month. This time only Toronto and Kingston have been heard from and Kingston reports only 15 messages handled by 3HE, mostly over short distances. Tests run between these two districts worked satisfactorily from 3GE

to 3HE but no signals were heard from 3HE.

In Toronto and vicinity quite a few stations have been in relay work, 3FO being most active with 49 messages, 3EI with 35, and 3GE with 15. All the above were on spark. 9AL on CW handled 24 messages.

District No 4 has no report this month from 3BP, who came for a while to Toronto to try his luck, but who gave up in despair and went back to Newmarket, saying that he could do more DX in a night there than in a month in the city with its thousand little qrmers. We believe him, and are glad his spark is not in Toronto to add to it.

### ALASKAN DIVISION

Roy Anderson, Mgr.

In spite of the fact that we had excellent weather for radio no one in the division heard anything in the way of stations that amounted to very much. Nothing further to report.

### PACIFIC DIVISION

J. V. Wise, Mgr.

John F. Gray of Del Mar, California has been appointed Assistant Division Manager. Other appointments will be announced later.

District A: The traffic route to the east has been in operation with 6ZZ and 6TV handling the bulk of traffic. 6AAH takes everything for Phoenix in addition to some eastbound traffic. 6RS will handle everything for the northern end of the state.

District B: 6ZB works C.W. on 375 and spark on 200. We have a new "OW" with us at 6BAZ who is reaching out very well.

District C: This is the C.W. district. 6EN will act in place of 6ZN until further notice. Practically all stations are QSO Denver and a direct route is being established. 6ZR, 6ZK and 6ZAF have been heard in Honolulu. Among the good working C.W. stations are 6XAQ, 6ALU, 6CU, 6KA, 6KY and 6JD. The sparks are 6ZAL, 6ZR, 6ALU, 6AMN, 6GP, 6ACY, 6ALD, 6BDZ, 6ADL, 6OD and 6OL.

District D: Mr. Winsor, 6AIF has been appointed Supt. of this district to which has been added the counties of Kern, Kings, and Tulare. San Bernadino has been transferred to "C." 6AIF clears with 5ZA and 6ZA and is the only station working at present, C.W. and spark.

Districts E. F. G. H. I: 6AS has been appointed Supt. of District "F" and 6GF of District "H." Practically every station in these districts has been able to work in all directions and no definite traffic routes have been established. 6AIX in Yreka is very close to the Oregon line and will handle northern traffic.

District J: 6ZO with his C.W. opens up another route east via 6ZA. 6QR is an old standby for traffic over the central route to the east and handles his share north and south as well.

### NEW ENGLAND DIVISION

**G. R. Entwistle, Mgr.**

The New England Division is undergoing a reorganization at the present time, the old relay routes are being polished and new ones are being whipped into shape.

Robert L. Northrup, 1COA, has been appointed executive assistant to the division manager. R. P. Siskind, 1ES, has been appointed City Manager of Boston succeeding P. J. Furlong who cannot give sufficient time to League work to do it justice.

D. Mix, 1TS, Assistant Division Manager, Connecticut.

H. W. Castner, 1UQ, Assistant Division Manager, Maine.

P. Robinson, 1CK, Assistant Division Manager, Eastern, Mass.

A. S. McLean, 1JQ, Assistant Division Manager, Western Mass.

J. F. Sullivan, Assistant Division Manager, Rhode Island.

L. G. Pollard, 1ARY, Assistant Division Manager, Vermont.

### ROANOKE DIVISION

**W. T. Gravely, Mgr.**

*Reported by A. G. Heck, 8CHO*

Because of the resignation of F. L. Bunker and K. K. Kramer who could not give enough time to carry on League work, Taylor M. Simpson of Winston, N. C. will handle the entire state until other appointments can be made.

J. F. Key has been appointed Assistant District Supt. of northern Virginia.

Outside of the report from 4EA there has been little activity to report in eastern North Carolina. Outlets to the south are very good through 4GL, 4GN, and 4BY. Some traffic has been going through 4EN, and 4CX.

3AOV is reaching out to the south and west and good work is being done by 3HL, 8ZX, 3BHX, 3BNM, 3AAL, 3BHS, and 3ZAA. 3RF, 3CA, 3BIY, and 3APA handled most of the traffic.

We miss the good old stations around Norfolk of 3EN, 3XY, 3ACT, 3ACJ, 3ADJ and 3ACK. What is the matter and when will you all be back?

In West Virginia 8SP has been the leader as a vast amount of traffic has been going through during the past month. 8AUE, 8WD, 8AXY, 8BDB, and 8CHO have come in for their share without a flinch.

Just in time comes word from Richmond that 3TJ and 3MO have had a siege of the flu but are recuperating rapidly with C.W.

and spark to help them. 3BLF on C.W. has handled some traffic, and has a daylight schedule with 3BHL of Crozet.

### NORTHWESTERN DIVISION

**H. F. Mason, Mgr.**

Extensive re-organization has been under way in this division.

Montana Section: About four stations in Montana have done consistent work through the static and northern lights which have prevailed during the past month. These are 7ZU at Billings; 7VZ at Libby; 7XB at Bozeman, who is working on 450 and has been logged off S. Carolina on a crystal; and 7LY, the A.D.M.'s station. 7EX is doing good work.

Washington Section: H. G. Reichert, 7CE, of Tacoma, our new A.D.M. is just getting things lined up and reports as follows: Traffic has moved briskly through Tacoma during the past month, stations handling DX being 7BC, 7BG, 7WM, and 7VZ on spark, and 7QE and 7CE on C.W. Incidentally, these are the only stations handling traffic on C.W. in the division. Miss 7CB will be on the air again. 7QE has been doing very good work on I.C.W. and has developed a near DX set. 7CE is planning a larger C.W. installation. 7BC reports early morning communication with 7MP a very easy matter, and has handled the bulk of the Tacoma traffic east.

D.S. Kinsey, 7PO of Seattle reports that most of the traffic there is being handled by 7IY, 7PO, and 7BK. Work can be done with 7FI, 7CK and 7MP at times but fading is bad. What we need is shorter jumps in getting the eastern traffic over the mountains and it may be that C.W. is coming to the rescue. 7RN of Cashmere and 7AAV of Wenatchee are both QSA on C.W. and as they are both located about midway between Seattle and Spokane there will be a clear ticket east. Seattle traffic has been moving regularly south to the sixes of whom a fair number are very consistent. Canadian 9AX, 9BD, and 5AK are worked to the north even though bad QSS. Canadian 4CB, at Morse, Sask. is also QSA is Seattle. 7SC of Seattle has moved to Aberdeen but he writes that he will have both spark and C.W. going again soon and will cut through the QSS which exists between there and Seattle.

Idaho and Central Section: 7YA, 7ZM, and 7YL are keeping things moving in fine shape on 375. Eastbound traffic on 200 however is nearly at a standstill. Old reliable 7FI is out with condenser trouble.

Oregon Section: Our old friend Royal Mumford of 7ZJ fame has been appointed Asst. Div. Mgr. and is lining things up in fine shape. 7BJ, at Vancouver, Wash., has been doing consistent work during the past month. 6AGF seems to be his best bet in the south with 7GE and 7FI to the



east and 7BK in the north. 7NN and 7KJ are also worked regularly. The Signal Corps at Vancouver Barracks signing CL8 have recently installed a 375 meter spark for the purpose of handling relay traffic. They work 7BC to the north and 6ZAE, 6KY, and 6KA to the south. 7ZU and 7YA have been worked from CL8 on their 15-watt fone, and the voice from a similar set at 7YA is very QSA here. 7ZJ is now handling A.R.R.L. traffic on schedule with 6ZAC of Hawaii who gives his QSL via mail. Bulk of traffic goes to 6ZK, 6ANG, 7ZU, 7ZM, 7YS and 7BK.

In Portland, 7JW, 7GJ, 7ZT, and 7BB are handling the bulk of the traffic. Owing to the fact that the higher power relay stations usually QRX early in the evening during the music broadcasts, relay traffic is handled at later hours and has fallen off. 7GJ managed to get in touch with 9YAK one morning when the QRM let up a bit. 7ED is back on the job again, clearing traffic in his accustomed manner. 7ZB is installing C.W.

C. A. Lockwood, 7TJ, the new D.S. at Salem reports heavy traffic, the most of which came through 6EX, 6AGF, 6AS, while in the 7th district most of it was handled with 7BC, 7BK, and 7JW. Eastern traffic is being routed through 6QR during the break in the 200 meter route in the Idaho section. Mr. Lockwood is to be commended on the manner in which he carries out his policy of sticking to the key until the hook is clear. 7IN of Salem is at present out of commission. The local radio club at Salem has appointed 7TJ traffic chief with two assistants, 7HA and 7MU. 7GO is doing good on C.W. Eugene traffic is being routed through 7YJ and 7OH of Corvallis. In Eugene many of the fellows are working out in fine shape. 7IW, 7HF, and 7MF are on the air every night. 7QT has recently come on the job with a ten-watt C.W. set. 7IL, 7HN and 7MF also have five watt sets.

Mr. Thibodo, our D.S. at Seaside, Ore. is with us again. 7KS is also back on the job after remodeling and has worked 7HF, 7TO, 7IW, and 7HM, 7NZ, 7NY, and 7NF have been heard on the air and we welcome these prospective relay stations.

### WEST GULF DIVISION

F. M. Corlett, Mgr.

**SOUTHEAST TEXAS DISTRICT;** Port Arthur territory is still out. Beaumont still dead. Kountze, Texas, writes words of encouragement thru their representative station 5ZAJ, but as yet are N.D. at Houston. At present our only relay east is 5ZAB which is located beyond our border. 5XB continues to be our star station under the able leadership of "Doc" Tolson. Mr. Tolson has just recently been appointed Asst. District Supt., and is giving us the

best that is in him. Bryan, Texas is fast coming to the front. 5MX is installing a ten-watt C.W. set at Bryan. 5QQ has opened up a much needed gap between 5XB and Dallas. 5XB announces that they will not accept traffic between the hours of 7 P.M. and 8:45 P.M. thru courtesy to the concert broadcasting stations, with which they interfere.

**SOUTHCENTRAL TEXAS DISTRICT;** 5XU with its corps of operators, holds the air most of the time. 5ZU says that his 100-watt C.W. set is measuring up to his most sanguine expectations. San Marcos never heard anymore altho it has three fine stations; 'smatter Stephens? Elgin with 5KP and his C.W. and sink set is on the air every nite and has had flattering reports from wonderful distances on both voice and C.W. using 15-watt set. 5XU handles most of the traffic for this district.

**SOUTHWEST TEXAS DISTRICT;** GP4 at Kelly Field Airdrome takes first place this month. What's the matter 5ZAK, can't you find that condenser? We often hear of shot condensers but a condenser that disappears is a new one on us. Sgt. Clark at



Laredo is probably the busiest station as he maintains a regular schedule with Eagle Pass and San Antonio daily clearing all traffic. 5MT is doing splendid work with a ten-watt set, working well into Kansas and Illinois. 5UF having the usual condenser and gap troubles. 5ZAE, 5CH, and 5ZAK have recently made a visit to Houston, and as this report goes to press, all three are rebuilding their stations. 5ZR is on occasionally but does not maintain a regular schedule. This district regrets the loss of San Antonio City Manager Rayburn, but because of other duties and his removal from the city, his resignation was tendered and acted upon. 5ZAK is constructing a new C.W. set of 200-watts. Many busy stations failed to make their usual reports this month, including 5TT, 5TG, 5CQ, 5ZW, 5ZAA, 5NK, and 5JI. Please note this, and in the future see to it that your District Supt. gets this information on the 15th of each month.

**NORTH TEXAS SECTION:** D.S. Martin of Amarillo reports radio activities in his District continue to increase and a number of receiving stations are under con-

struction. Experimenting amateurs continue to enjoy the radio phone concerts, the preaching and other radio phone experiments.

51F is continuing to relay traffic between east and west assisting 5ZA to get the stuff across. The usual route for west traffic being to 6ZZ and 6TV. 6ZZ being the most effective and consistent owing to the QRM from ninth and fifth district stations. 6TV is QSA at 51F but closer stations crowd him out. 6AAH and 6APP are trying to establish relay schedules with 51F but the same QRM prevents them being readable for traffic.

Traffic north has been going via 9DUG, 9ZAC, 9ABV, 9WI, 9DEZ and 9DSD. Stations 9DSD and 9ABV have been most consistent for both transmitting and receiving of traffic in their direction.

Traffic for east, southeast and northeast has been handled through 5FO, 5HK, 5IR, 5IS, 5XU, 5NC, 5NK, 5XJ, 5BY and 5PE. 5PE, 5HK and 5XU have been most consistent. The others have been QSA and were good relays at the time they were worked.

The NORTH CENTRAL DISTRICT is still plugging along in grand style and has managed to run up a few messages. 5NS, 5FI, 5QQ, are keeping things hot up their way. Edwin Gaston of the Granbury territory has been appointed City Mgr.

D.S. Neel, Dublin, Texas is having a hard time of trying to hear from some of the stations in the northern part of his District and would appreciate a letter from any of the stations up that way.

Abilene is getting along, 5YN being the most consistent station at this time.

Alton McCallan of Stamford has been appointed City Mgr. of that City.

Brownwood is doing some fine work and is ahead of most of us in as much as they have one of the liveliest clubs in this District.

All stations in Dublin are running fine with 5IR the star station. 5XJ has been crippled a great deal as one of the best operators, Mr. House has moved away.

5AO, Hamilton has been reaching out, but the fierce winds that have visited this part of the country lately, got the best of his aerial. Mr. Jordan has been appointed City Manager of Hamilton.

Report from NORTHEAST TEXAS is slim this month. Colwell reports traffic still moving in fine shape.

E. R. Mansnerius 5NC, Dallas desiring to show Mr. D. W. Hume, F.D.D. of Government Saving Division the power of amateur radio, suggested to Mr. Hume to give him a message destined to all Postmasters in Texas, New Mexico and parts of Oklahoma. Mr. Hume consented and received the surprise of his life. Mansnerius broadcasted this message nightly from his

station, likewise giving it to every station he could raise and further kept the pot boiling by sending a copy of said message to 5NK at Houston, 51F at Amarillo, 5ZA at Roswell, N. M., 5IS at Greenville, 5XJ at Dublin asking them to go to the limit in getting a copy to every station in Texas and New Mexico. With the untiring efforts of these real bugs and others Mr. Hume's office was flooded with letters and messages from postmasters and several good sales resulted from same. Mr. Hume wishes to thank the above parties and all members of the A.R.R.L. who did their bit in putting this over and is so enthused over it he has come back for more, giving Mansnerius another message.

## SECOND DISTRICT CONVENTION

*(Continued from page 34)*

Second District Executive Radio Council and a rising call of all the A.R.R.L. members present, which included approximately two thirds of those present. F. H. Schnell, our Traffic Manager, was next on the speakers' list and gave a report of the President's-Governors' Relay which was run just prior to the Convention. Following our Traffic Manager, Paul Godley of Transatlantic fame discussed further some of his Transatlantic experiences and international amateur radio. He was presented with a large bronze tablet commemorating his work in Scotland, the gift of the amateurs of the second district.

All of the amateurs present who were successful in the Transatlantic tests were then introduced the following being on hand: 1AFV, 1BCG, 1XM, 2AJW, 2BK, 2DN, 2EL, 2FD, 2ZL and 8XV. Our President Hiram Percy Maxim was the next speaker on the list but was unable to attend, a telegram being read expressing his regret at his inability to be present, because of illness. Sickness also robbed the banquet of two other interesting talkers, Mr. E. H. Armstrong and Mr. George E. Burghard.

J. Andrew White, editor of "Wireless Age", told some amusing anecdotes on broadcasting and related some of his experiences operating at the broadcasting station WDY. The last speaker on the program was our secretary-editor, K. B. Warner, who spoke on the relations of the A.R. R.L. at the radio conference at Washington and the policies that were being followed.

At the conclusion of the banquet a reception was given to Paul Godley and everyone had a chance to shake with the man who made the A.R.R.L. Transatlantic successful.

This was the final event of the convention, and everyone declared it a very successful one and long to be remembered.



# Amateur Radio Stations



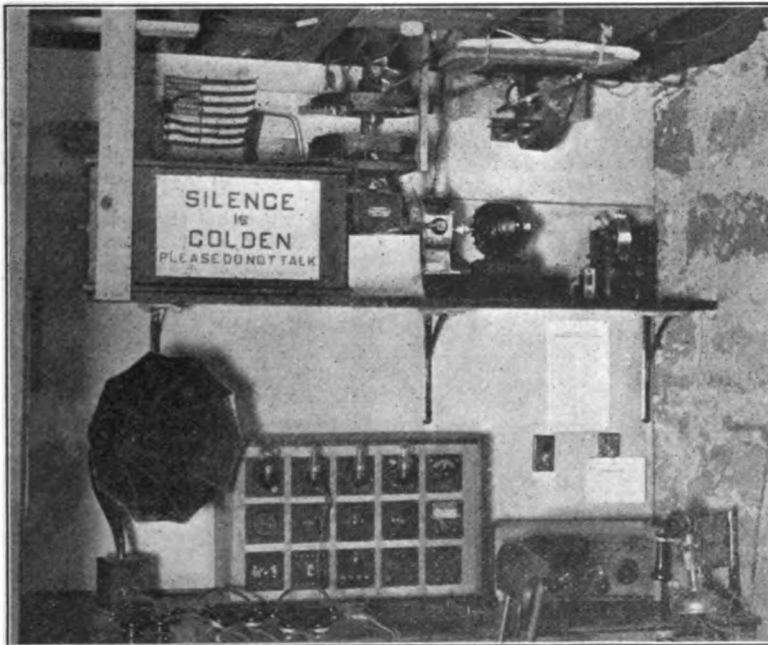
## 7ZU, Polytechnic. Montana

7ZU is the station of Glenn E. West and has been particularly active in transcontinental relay work during the past season, being one of the connecting links with the Northwest.

The antenna is a 17-wire vertical fan supported on two masts 65 feet high and 70 feet apart. The masts are in three sections, the first being 30 feet high by six inches square, while the remaining two are

United Wireless "coffin," Dubilier .007 mfd. condenser, Benwood sink gap and a rather interesting oscillation transformer, being made of heavy multiflex braided copper ribbon, the size of which gives an effective width of eight inches in the primary coil and four inches in the secondary. The antenna current is 4.9 thermo-couple amperes on the 375 meter wave.

The receiver is entirely home-made and



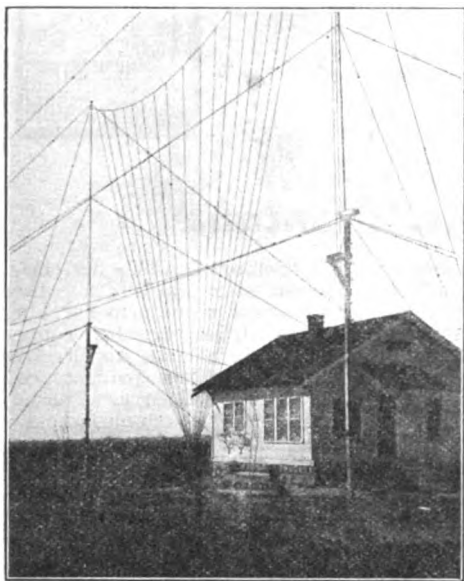
of two-inch galvanized pipe. Eleven guy wires are used to stay each mast. The ground system consists of a Rounds' round ground using old hot water tanks evenly spaced in a circle 40 feet in diameter and buried to a depth of four feet. A heavy insulated wire runs from each tank to the oscillation transformer. This gives a most effective ground system and certainly one of low resistance.

The transmitter uses a one kilowatt

comprises a short wave regenerative set using variometers with a detector and three-stage amplifier, the third stage being used only when the Magnavox is in circuit.

7ZU is located at a very strategic point and serves as a kind of clearing-house for coast-bound traffic. Regular schedules are maintained with 7ZJ at Vancouver, Washington, and 9YAE at Le Mars, Iowa. These jumps are both around 900 miles and very consistent work has been done in spite of

the distance. Signals from 7ZU have been reported frequently on both coasts and the working record is approximately 2200 miles.



A new 100-watt C.W. set has just been added and it is hoped that it will maintain good consistent communication during the summer season and be of help in working through some of the fierce Ninth District QRM. The plate supply is from a 1500 volt motor-generator unit of 250 watts capacity. Further details are lacking but we will wager that the C.W. set will be heard in a goodly portion of the country.

## ***Canadian 9BD, Vancouver, B.C.***

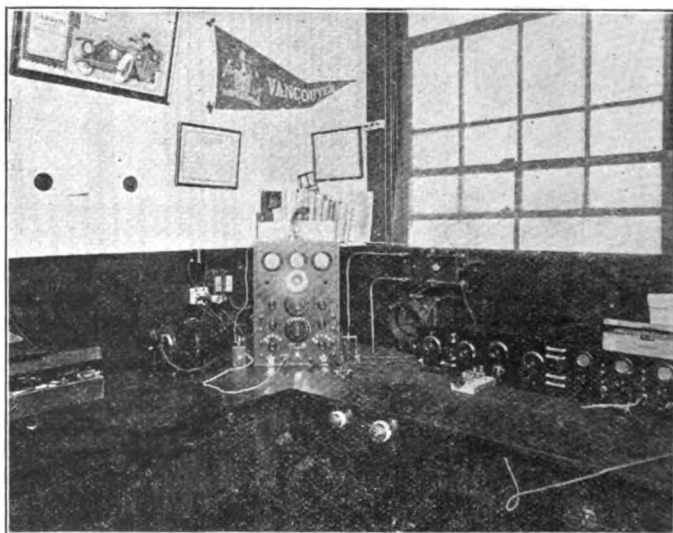
We take pleasure in presenting this month one of the star stations of our Canadian cousins of the Northwest. 9BD is located in the Barron Hotel, Vancouver, and owned by William D. Wood. It is a special licensed station for operation on 200 meters, with spark and valves.

The spark transmitter, which is enclosed under the table, consists of a 1-kilowatt Thordarson transformer, Benwood sink gap, condenser of four Marconi jars giving a total capacity of .012 mfd., and an extra heavy O.T. A 1-kilowatt United Wireless "coffin" is so arranged that it may be used in place of the Thordarson. The spark transmitter uses a tuned counterpoise with the regular ground and an antenna current of 3.8 amps is obtained on a 480 spark note, and 4.6 amps on a 240 spark note.

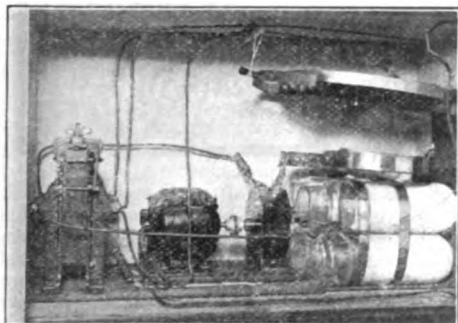
The antenna and counterpoise are located on the roof of the hotel which is 110 feet above the street level. A 41-foot pole supports the free end and a 36 foot pole the lower closed end. The aerial proper is an inverted L of seven wires with a cage lead-in, giving a total length of 100 feet. A counterpoise is used, being a duplicate of the antenna and 80 feet long. A ground is also used and the counterpoise tuned with the small O.T. under the antenna switch, which results in better antenna characteristics.

Like most of the progressive stations, 9BD has a C.W. transmitter to work with when the conditions are not suitable for spark and which has been reported up and down the Pacific coast and across the Rockies, to 4CB in Saskatchewan who has

**Station Interior  
At Canadian 9BD,  
Vancouver, B. C.**



been worked successfully. The C.W. transmitter uses four Western Electric VT-2's in a reversed feedback circuit which has



been very popular of late. The plate potential is supplied by a 500-volt motor-generator unit which may be seen in the photo-

graph near the transmitter panel. Controls are so arranged that either phone or C.W. may be used. The phone circuit uses two tubes as oscillators and two as modulators in a Heising system and has given a very good range, being heard in Portland, Oregon, a distance of approximately 350 miles. The antenna current is 1.5 amps. with an input of 50-watts on a wave length of 230 meters.

The receiver consists of a Radio Shop regenerative tuner with a home-made detector and two stage audio amplifier. A long wave loader may be inserted in place of the series condenser, which loads up the regenerator to 1800 meters with good efficiency.

9BD has taken an active part in the relay work in the Northwest and his signals have been reported on both spark and C.W. up and down the Pacific coast and the spark has been copied in Hawaii by a ship operator.

## *1BLE, Boston, Mass.*

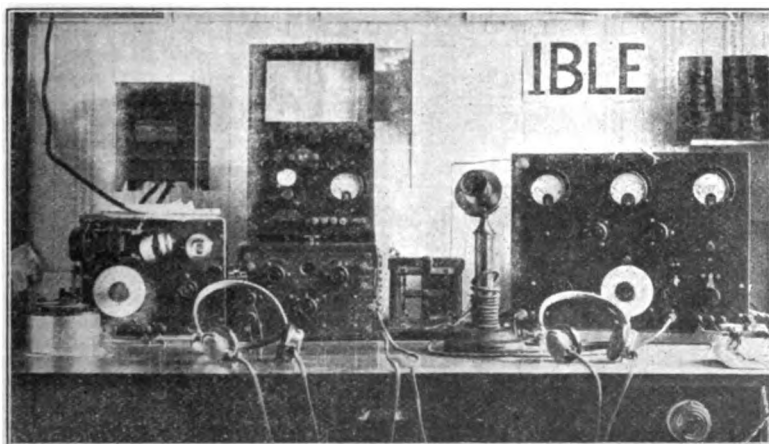
Here is the station of Mr. Alfred Brust at 1289 Massachusetts Ave., Arlington Heights, Boston, which has done very good work with its 20-watt C.W. transmitter and phone.

The antenna is an inverted L, two wires 90 feet long and 5 feet apart at a height of 50 feet. A counterpoise is used and con-

sists of six wires spaced 5 feet apart, centered directly under the antenna. The transmitter is a twenty-watt outfit using Radiotrons and is so arranged that two tubes may be employed as oscillators and two as modulators in a Heising system. The oscillating circuit is a Colpitts. Convenient switching arrangements are provided whereby phone, straight C.W. or buzzer modulated may be used. The antenna current approximates  $1\frac{1}{2}$  amperes.

The receiver uses honeycomb coils in the usual three-coil circuit, a detector and a two-step General Radio amplifier, on which amateur stations from all districts except the sixth and seventh have been copied, as well as the long wave commercial and naval arcs.

The call 1BLE has just been re-issued and Mr. McNamara, the operator, is an-



sists of six wires spaced 5 feet apart, centered directly under the antenna.

The transmitter is a twenty-watt outfit using Radiotrons and is so arranged that two tubes may be employed as oscillators and two as modulators in a Heising system. The oscillating circuit is a Colpitts. Convenient switching arrangements are provided whereby phone, straight C.W. or buzzer modulated may be used. The antenna current approximates  $1\frac{1}{2}$  amperes.

The receiver uses honeycomb coils in the

xious to receive further reports on his signals.

### **Correction Notice.**

The advertisement of the Crosley Mfg. Co., on page 131, March QST, describing the Crosley Harko Senior Radio Receiver was, through a typographical error, made to read: 'The hook-up is special—of our own design and is now regenerative.' This should read: —“and is NOT regenerative.” —Ed.



**T**HE A. R. R. L. has the pleasure of announcing the completion of affiliation of the following societies as of Feb. 17, 1922:

Huron Radio Club, Huron, So. Dakota.  
 Amateur Radio Association of Parker, Parker, So. Dakota.  
 Twin City Radio Club, Minneapolis, Minn.  
 Holland Radio Association, Holland, Mich.  
 Chantien Valley Radio Club, Crafton, Pittsburgh, Pa.  
 Groton Radio League, Groton, N. Y.  
 Asbury Park Radio Club, Asbury Park, N. J.  
 The Reading Radio Club, Reading, Pa.  
 The Trumbull Radio Club, Niles, Ohio.

Some of the club papers that we find great pleasure in reading and which were received last month were:

Wouff Hong, by I. R. R. L. Iowa.  
 Rome Radio News, by Y.M.C.A. Radio Club, Rome, N. Y.  
 Radio Digest, by Springfield Radio Ass'n.  
 Delta Division News, By A.R.R.L. Delta Division.  
 The Oscillator, by Y.M.C.A. Radio Club, Sioux Falls, S. D.  
 Kick Backs, by Twin City Radio Club, Minneapolis, Minn.

#### **The Chelsea Radio Association (N. Y.)**

Meetings are held every Thursday night at 8 o'clock in the Hudson Guild Clubhouse, 436 W. 27th St. At the last meeting Mr. Wilson of the Western Electric Co. talked on the construction, care and practical operation of vacuum tubes. A large crowd of members listened to Mr. Wilson's very interesting talk.

#### **Lansdowne Radio Association, (Lansdowne, Pa.)**

The Lansdowne Radio Association now has about 25 members after starting out with 8 members two months ago. Plans are now being made to install a complete transmitter and receiver for relay work. Meetings are held every Tuesday evening at 8 o'clock in the rear of No. 16 Wycombe Ave. Visitors are always welcome.

#### **Lowell Radio Club (Lowell, Mass.)**

Club members of the Lowell Radio Club entertained members from the Interstate

Radio & Research Club of Haverhill, E. M. Robinson, of Boston showed pictures of the action of Vacuum Tubes. Walter Butterworth, Assistant Radio Inspector of the first district made an interesting talk on the enforcement of Government regulations. Refreshments were served during a general Ham Fest in which all indulged.

#### **Rocky Mountain Radio Association**

At a recent meeting, Professor Hyslop of Denver gave an interesting lecture on the fundamentals of radio, demonstrating same with tuning forks and pendulums. The Olinger Hylander Radio Club also of Denver was affiliated with the Rocky Mountain Radio Assn. at the last meeting.

#### **The Houston Radio Club**

The Houston Radio Club held its Second Annual Banquet and "hamfest" in the Y.M.C.A. Banquet room, on Saturday nite, February 11th. The decorations were unique, and featuring a theme of Americanism. Beautiful silken national flags were everywhere in evidence and the color scheme of the red, white and blue, together with "stars of the ether" decoration was most effective. A perfectly constructed antenna system in miniature was the table motif and with Southern Pine and Spanish moss forming runners for the center of the table. The illumination of the table was augmented by tapers in the national colors. After dinner talks were made by the prominent visiting guests and officers of the A. R. R. L. Among the prominent out of town guests were: Mr. Frank M. Corlett, of Dallas, Division Mgr. of the West Gulf, and A. R. R. L. Director; Mr. L. B. Henson, of the Police and Fire Signal Dept. of Dallas, Asst. Div. Mgr. in charge of Police Broadcasting; Porter T. Bennett, of Dallas Radio Club; W. A. Tolson, Asst. District Supt. East Texas of A & M College, E.E. Dept. and a score of visiting operators. February 12th was devoted to informal get-together meetings and tours of inspection.

#### **Norwich Radio Club**

Some of the recent means of increasing interest in radio club organization were carried out by the Norwich Radio Club. Spelling contests or radio terms, Edison questionnaires on radio in general, alphabetical contests of radio terms, etc., are

some of the things which has given the club an increase in membership.

#### M. I. T. Banquet

The third annual banquet of the M.I.T. Radio Society was held on February 25th under auspices of the Boston Executive Radio Council and the Massachusetts Institute of Technology Radio Society. During the afternoon a splendid exhibit of apparatus held the attention of every amateur who attended. Promptly at 6:15 o'clock 480 joined in and enjoyed a delicious dinner. Several comic movies were shown along with the pictures of the stations that were successful in spanning the Atlantic Ocean during the Transatlantic Tests. Im-

R. R. L. Convention with a resume of what had been done in the past and outlined plans for the future. The convention was held at Lansing, Mich. on Feb. 10th and 11th.

F. D. Fallain of Flint, Mich. acted as toastmaster at the banquet. The delegates were welcomed to the city by Max Henderson, President of the Central Michigan Wireless Association. Mr. Parkhurst, assistant eighth district radio inspector spoke on the coming changes in radio regulations. Immediately after the dinner everyone adjourned to the Majestic Theatre where a program was heard from the Detroit News Service station. Saturday morning Prof. N. H. Williams of the U. of M. gave a



mediately after the banquet some confusion at the door aroused the gang to its feet and who should come bumping through the crowd but The Old Man with a hand bag. He told of his expensive experience with vacuum tubes and when he opened his bag to exhibit his last tube out jumped the cat.

F. D. Webster was toastmaster and he introduced several speakers among which were Sumner B. Young, chairman of the Boston Executive Radio Council, F. H. Schnell, traffic manager of the A. R. R. L., Dr. E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, and Dr. Frederick S. Dellenbaugh of M.I.T. Walker Memorial was the scene of this well managed affair which came to a close near midnight.

#### Michigan A.R.R.L. Convention

Clyde E. Darr, Superintendent of Michigan opened the first annual Michigan A.

lecture in which he explained by using slides how the ether waves are produced and the necessity for exact tuning in each circuit.

In the evening R. C. Wyckoff of 8YG explained the operation of the C. W. set at 8YG. It is said that many spark sets were on sale following this lecture as the spark hounds had been converted to C. W. (We need a few more conventions like this to lay the spark to rest forever.) T.M.

#### The Milwaukee Amateurs' Radio Club

The Milwaukee Amateurs' Radio Club was founded in 1917. Up to the time of our entrance into the war the club made great progress in the amateur field but activities were discontinued during the early spring of 1917. The club became active immediately after the lifting of the ban on amateur radio and at the present time is doing world's of good in developing the

amateur situation in Milwaukee by catering to all classes of radio enthusiasts. Meetings are held at 8:00 o'clock every Monday evening except the third Monday in the Trustees' room of the Milwaukee Public Museum. Our limited space forbids publishing the complete history of the club which shows a splendid spirit of team-work. Copies of the history of the club can be had by writing to the club at 601 Enterprise Bldg., 2nd and Sycamore Sts. Milwaukee, Wis.

### A Contest

The Arkansas Valley Radio Association, a recently organized association to promote radio throughout the Arkansas River Valley and to aid the American Radio Relay League is holding an interesting contest. The headquarters for this organization are at Wichita, Kansas, where at



the last meeting it was decided to give a cup as a trophy to the station obtaining the longest distance record of actual communication.

Here is a view of the handsome cup

The purpose of this contest is to stimulate interest in radio communication throughout that particular section of the country during the month of April. It is planned that if this contest is successful and meeting the approval of the A.R.R.L. members in that territory, another contest will be held embracing the entire country including Canada. No one will be allowed to compete that does not hold a li-

cense. Special licensed stations and experimental stations will not be considered. For the present contest, stations in Texas, Oklahoma, Colorado, Arkansas, Missouri, Nebraska and Kansas are eligible. Every report must be accompanied by a verification of the station worked, the distance in miles, and a complete description of the station. All reports must be in by May 20th, so that the cup may be awarded by June 1. All communications and reports should be mailed to O. W. Taylor, 1350 South Francis St., Wichita, Kansas.

### MORE ABOUT THE TRANSATLANTICS

*(Continued from page 39)*

regular commercial service. If in a single night Mr. Godley received eighteen American stations, nevertheless for six other nights he did not receive a single one. It is true that with the small power employed and the great distance to cover the obstacles made by atmospherics took on considerable importance. But may we not say that the moonlight had on its part an effect of enormously enfeebling the signals?

"But what is most striking is the curve of the results obtained, the number of stations received having been successively 1, 0, 18, 7, 0, 0, 0, 0. Now December 15th was the day of the full moon and Mr. Godley did not hear anything but feeble signals from the 12th on, including the 15th which was a beautiful moonlight night. We know that short waves are particularly sensitive to the absorbing effects of light. Transmission over a great distance with small power must have made this effect particularly noticeable, and if really long waves are manifestly influenced by the variations in luminosity which eclipses of the sun produce, is it not perhaps reasonable to suppose that a simple moonlight night might make feeble to the point of rendering illegible signals transmitted on a wave length of 200 meters from a distance of more than 6000 kilometers?

"The 'Wireless World' on its part puts forth the hypothesis that the inequality of the reception might be due to large cyclonic disturbances which were produced on the Atlantic during the test. In order to verify this it is about to consult the documents of the Meteorological Office.

"Whatever may come of these facts, further experience will doubtless clear them up and we can still say that our American and English comrades have rendered great service to Science and have helped the cause of radio amateurs. Thanks to them, and thanks to the transatlantic transmission realized under conditions heretofore deemed impossible with only amateurs transmitting as well as receiving, perhaps we shall hear less said of us, and with but a shade of superb disdain, "Oh yes, do you know that this is the man who made himself up a detector out of tinfoil!"



# Who's Who in AMATEUR WIRELESS



F. A. Hill



A. L. Groves

We take great pleasure in presenting to our readers this month Mr. Frederic A. Hill of Savannah, Ga., better known through the air as the wielder of that wicked bug at 4GL. Mr. Hill was born in Philadelphia "some time ago," being too bashful to tell us his age. He had a transitory existence in Mexico for twelve years and journeyed to the Philippines, China, Japan and Borneo for several years in the capacity of a newspaper man and radio bug. He returned to the United States in 1914, locating in Chicago where he operated a quarter kilowatt "sawmill" under the call of 9KJ. In 1915 he removed to southern territory and has remained there since, with the exception of eighteen months on board vessels of the United States Shipping Board. The last two years Mr. Hill has been serving as Shipping Board assistant

(Concluded on page 61)

Here's another man we wanted to see. Haven't you been wanting to know all about the man who has supplied us with such detailed information on honeycomb coils and his own famous single layer coils?

Mr. A. L. Groves was born September 11, 1888, at Brooke, Va., and attended the public schools at Brooke and Fredericksburg, Virginia, later attending the Dale Military Academy where in 1904 he brought down the wrath of one of the Professors on his head because he had strung up a telegraph wire between two buildings and the "hum" of the wire kept the Prof. awake. Mr. Groves regrets that they didn't know anything about spark gaps at that time or the "hum" on the wire might have been of a different tone. That was the beginning of his inquiries into the electrical world and he tells us that he can't re-

(Concluded on page 61)

## With Our Radiophone Listeners

### General Electric Announces New Radio Broadcasting Station WGY

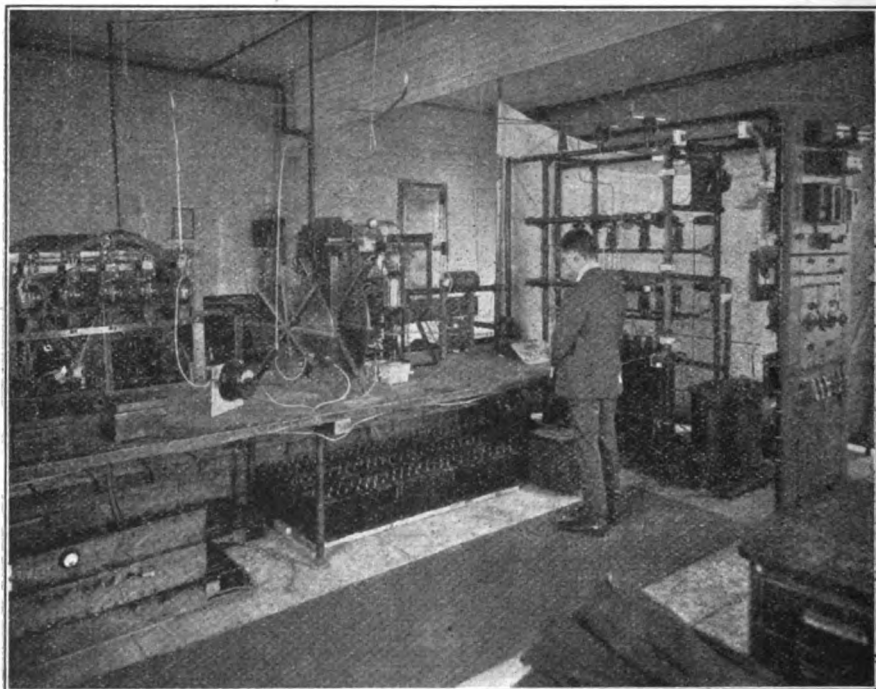
A radio broadcasting station, more powerful than any now sending out programs, has been installed by the General Electric Company at its plant in Schenectady, N. Y.

From the roof of a five story factory building, two towers 183 feet high and spaced 350 feet apart, support an antenna at such height as to give the wireless waves unobstructed freedom in all directions.

no indication of the distance this station may be heard.

Broadcasting stations with but a fraction of the power of the G-E Station have been heard at distances of 2,000 miles or more under favorable atmospheric conditions.

The General Electric station has been licensed to operate on a 360 meter wave length under the call letters WGY. It is equipped with the most modern of radio apparatus, including the multiple tuned



The interior of WGY, Schenectady, N. Y.

This station has not been regularly operated nor has advance announcement been made of the impromptu or test programs sent out, which would cause amateurs to be listening, yet letters have been received from such distant points as Cedar Rapids, Iowa, Minneapolis and Santa Clara, Cuba, the latter place 1450 miles distance, announcing that the programs have been heard. These reports come from operators who, in an evening's experimenting with their receiving sets, have accidentally come upon the waves from Schenectady and are

antenna which, because of its many advantages, has been installed in Radio Central, the world's most powerful commercial station at Rocky Point, L. I., and other transoceanic stations of the Radio Corporation of America.

A three room studio, where the programs are produced, is located in a Company office building, 3000 feet from the transmitting station. One room is used as a reception room for the artists, where they may sit and chat until their time on the program arrives without danger of inter-

fering with what is going on in the studio. The second room is the studio, where a concert grand piano, victrola, an organ and other equipment for the artists are to be found. Here a number of portable microphones, which are commonly known as pick-up devices, can be shifted about to locations best suited for the reception of announcements, musical numbers, or whatever may be sent out. In the room on the opposite side of the studio is apparatus for amplifying the sound waves before they are transmitted by wire to the broadcasting station.



The antenna at WGY

A switchboard in the studio, which lights a red light when the station is in operation thus warning persons in the room that whatever they might say will be sent out to thousands of ears of an invisible audience, is within reach of the studio director at all times. Not until he throws a switch can anything reach the antenna. A telephone attached keeps him constantly informed just how the program is going out and allows him to change position of the artists or microphone if such is necessary to improve the tone quality of the entertainment.

With the exception of the small pick-up devices or microphones and the switchboard, there is nothing in this room to indicate it as different from any musical studio.

In the apparatus room, the sound waves are put through a number of steps of amplification by means of vacuum tubes which increases their volume thousands of times. The amplified sounds are then put into a

wire and sent to the broadcasting station, where they enter another bank of vacuum tubes, known as modulators or molders of the electric waves.

Direct current at a high voltage is necessary for the operation of a transmitting station. To obtain this, a 220 volt alternating current line, which is but little higher than the voltage used for lighting purposes in the home, is boosted to 30,000 volts by means of a transformer. This voltage is then applied to a number of vacuum tubes, acting as rectifiers, which change the alternating to direct current. Placed between the rectifier and the modulator or molding tubes, is a high power oscillator tube. The electric power entering this tube sets the ether into vibration and upon these vibrations the electric waves, molded into shape in the modulator tubes, are sent to the antenna to go out into space.

#### Ship-to-Shore Telephoning

Thomas H. Rossbottom, General Manager of the United States Lines, is the recipient of hundreds of telegrams and letters of congratulation on account of his pioneer work in using the wireless telephone in communication with the big liner "America" a short time ago.

Maritime history was made by Mr. Rossbottom in his use of the wireless telephone in receiving the report of his Captain and in transmitting orders to the ship. This is the first time in history that the commander of a merchant vessel has made his report to the operator by wireless telephone, and that orders from the operator were transmitted to the ship by the same medium. The occasion for this was the arrival of the Steamship America on March 6.

While the America was still considerable distance from Ambrose Channel Lightship Mr. Rossbottom was connected up thru the powerful station at Deal Beach, N. J. Within ten minutes after the call was made Captain William Rind of the America was on the telephone. After an exchange of greetings Captain Rind told Mr. Rossbottom the speed he was making, and the time he expected to reach Quarantine. Mr. Rossbottom in reply gave his instructions to Captain Rind concerning the special arrangements which has been made with the Public Health officials at Quarantine station for the passing of the vessel beyond the sunset hour.

Mr. Rossbottom and Captain Rind conversed for several minutes. Mr. Rossbottom talked over the telephone at his desk, the one that is normally used in his daily business, and without any special appliances. In talking to the ship Mr. Rossbottom's orders went over the telephone wire to Deal Beach, N. J. There in the big transmitting plant his words were con-

nected to the radio and were shot out from the antenna to the America's aerial and down to a receiving telephone at which Captain Rind listened. Captain Rind's words in reply were sent from the aerial on the steamship to the big receiving station at Elberton, N. J., and then came over the telephone wires to the office of the United States Lines at 45 Broadway.

#### NEBRASKA WESLEYAN UNIVERSITY STATION 9YD

A broadcasting station has been erected at Nebraska Wesleyan University, University Place, Nebraska, for the purpose of sending out the weather forecast and market reports which are received daily from the Bureau of Markets, at Lincoln, Nebraska. The reports are first sent out by code on a 1-kilowatt spark transmitter with an approximate range of 200 miles and later repeated by telephone which has a range of 100 miles under normal conditions. The schedules are as follows:

Weather forecast and news bulletin, daily except Sunday, 8:50 to 9:00 a.m..

Market and weather forecasts, daily, 4:00 to 4:15 p.m.; and Saturday, 12:15 p.m.

Concerts and lectures Tuesdays and Thursdays, 9:30 p.m.

The station of the Doubleday-Hill Electric Co., WQY, at Pittsburgh broadcasts concerts on the following schedule:

Daily except Saturday and Sunday, 4:30 to 5:00 p.m.

Saturdays, 1:00 to 1:30 p.m.

Sundays, 4:00 to 5:00 p.m.

Night schedule, Monday, Wednesday and Fridays, 9:30 to 10:00 p.m.

The radio telephone is coming into prominence in Australia and a station is now in operation at Dunedin, New Zealand, that has been heard in Wellington, New Zealand by Mr. A. McClay, A.R.R.L. member, a distance of approximately 400 miles. The station at Dunedin was using a very small transmitter but a much larger one is to be installed soon and amateurs all over New Zealand will be able to listen to the concerts.

#### San Francisco Bay Radio Telephone Schedule

##### Broadcasted on 360 meters

Every afternoon except Sunday—3:30 to 4:30 P.M., Atlantic Pacific Radio Supplies Co., Concert; 4:30 to 5:30 P.M., Leo J. Meyberg, Press, Market and Concert.

Every night except Sunday—7:00 to 7:10 P.M., Atlantic Pacific Radio Supplies Co. Press, Sports and Foreign; 7:10 to 7:20 P.M., Hotel Oakland, Press, General News; 7:20 to 7:30 P.M., Leo J. Meyberg, Press, Financial and Weather.

Sunday—10:00 to 11:00 A.M., Leo J. Meyberg, Concert; 11:00 to 12:15 A.M.,

Trinity Center, Sermon; 12:15 to 1:00 P.M., Warner & Linden, Concert; 7:00 to 9:00 P.M., Presidio, Concert and Instruction.

Monday—7:30 to 8:30 P.M., Colin B. Kennedy, Concert and Industrial News; 8:30 to 9:00 P.M., Leo J. Meyberg, Concert.

Tuesday—12:15 to 1:00 P.M., Warner & Linden, Concert; 7:30 to 8:15 P.M., Hotel Oakland, Concert; 8:15 to 9:00 P.M., The Radio Shop, San Jose, Concert.

Wednesday—7:30 to 8:15 P.M., Atlantic Pacific Radio Supplies Co., Concert; 8:15 to 9:00 P.M., Herrold Laboratory, San Jose, Concert.



Getting the latest dope by radio.

Photo by Underwood and Underwood.

Thursday—7:30 to 8:30 P.M., Leo J. Meyberg, Concert; 8:30 to 9:00 P.M., Colin B. Kennedy, Concert.

Friday—12:15 to 1:00 P.M., Warner & Linden, Concert; 7:30 to 8:15 P.M., The Radio Shop, San Jose, Concert; 8:15 to 9:00 P.M., Hotel Oakland, Concert.

Saturday—7:30 to 8:15 P.M., Warner & Linden, Concert; 8:15 to 9:00 P.M., Atlantic Pacific Radio Supplies Co., Concert.

#### Westinghouse Broadcasting News

"Radio Broadcasting News," a weekly newspaper, has been established to mark the first anniversary of KDKA, the Westinghouse broadcasting station at East Pittsburgh, Pa.

About one year ago the Westinghouse company broadcasted its first program (Concluded on page 61)

# Strays



In C.W. transmitting circuits where shunt power feed is used, necessitating a radio-frequency choke, amateurs always have had difficulty. A big honeycomb coil is commonly used for this purpose, altho it is well known that a tuned circuit consisting of a small honeycomb coil and a shunt condenser resonated to the wave length used, is much more effective. However, it's troublesome and the voltages build up terrifically. Here's the answer: use a variometer—any garden variety of short-wave variometer. Simply insert it in any circuit that needs a radio-frequency choke and adjust it to where it chokes the best, which in parallel-supply transmitters is where the antenna current is highest.

Dr. Louis Cohen, chief of Army Radio Research, is said to have perfected a stray eliminator that really works. We hope that some dope on it can be given to the world soon. We understand it has been tested in Army stations in Texas, where by the way they have *some* static. In this case the strays were so severe that it could barely be determined that the other station was transmitting, yet with the eliminator in the circuit the signal could be read nicely and there were no disturbances. Sounds like a dream, doesn't it?

The Navy research folks have discovered a way of eliminating the mush from arcs. This is stright dope. Praise God from whom all blessings flow! The improvement is to be installed in the various Navy arc stations as rapidly as appropriations will permit.

Entries in the competition for the Herbert Hoover Cup for 1921 closed on March 1st. A goodly number of entrants came forward with their material, of course, and the Secretary's cup will be honoring America's best home-made amateur station as soon as an award can be determined.

NOF, sometimes NSF, in Anacostia, D. C., the Navy's amateur-built and amateur-operated station, has been heard "more than once", as Mr. Dow puts it, at 6ZAC in Hawaii, a Great Circle distance of 4780 miles, using buzzer-modulated I.C.W. Fine business, "LC"—congratulations!

Mr. Dow, incidentally, reports 9XM and 9YAE as the latest heard. Soon he's to have a transmitter. Mr. A. H. Babcock has built a duplicate of 6ZAF for him—two 50-watt tubes, self-rectifying—and it was recently tested out in Berkeley and copied OK by Dow, and is now enroute to him by steamer. Perhaps by the time this issue is in circulation 6ZAC will be on the air, and if only a little quiet air can be got on the West Coast to listen for him—Oh Boy! Isn't that a relay for you!

3ZO says that radio men talk about only two subjects—and radio is one of them.

Rumor had it during the Transatlantics that a radiophone signing WQM had been heard in London. This station cannot be located and information concerning it will be appreciated. It was at one time assigned to a phone station of the Kansas Gas & Electric Co. at Wichita, Kansas, but was dismantled at the outbreak of war and has not been in operation there since.

We were surprised to learn while in Washington attending the Radio Conference that the Navy Department in the design and purchase of their equipment are following the proposals of the so-called Paris Technical Conference of last summer, which was a preliminary to the forthcoming International Communications Conference. Our surprise is due to the fact that we don't believe the determinations of the Paris Conference have a ghost of a show of being adopted. They have been completely discredited and repudiated by the commercial and private interests in this country, as being at total variance with the pre-meeting agreements of all U. S. interests. The military representatives of every country dominated the Paris meeting and their findings gave the military interests the big end of everything in radio. By the trend of the times we should say that this viewpoint is quite likely to be an unpopular one by the time the International Conference sits.

6ALE, Lindsay at Reedley, Calif., is now 6ZF, and is putting up a new aerial for his Z wave. He continues to copy 2FP quite often, hearing him several times on the

night of Feb. 17th and copying him practically solid for several hours on Feb. 20th.

Foolish question No. 1,088,333: What organization represented Amateur Radio at the Hoover Conference?

#### Read 'Em and Weep

On the night of Jan. 20th at 10:30 p.m., F. W. Applegate, 3FP of Trenton, N. J., heard 6ALE and copied a msg. addressed to 2ZL.

6FU, C. F. Filstead of Los Angeles, using one 5-watt tube with 1100 volts on the plate, was heard by 9AIG, Sioux Falls, S. D., on Jan. 28, a distance of 1350 miles.

9AMB, Mr. D. L. Hathaway at Denver, was heard on Nov. 6th by G. C. Farmer on the Str. West Prospect while 3300 miles west of San Francisco or 4300 miles from Denver. One fifty-watt tube with 1250 volts d.c. was used at 9AMB.

Mr. J. B. Cugginano of Brooklyn using a flivver coil has been copied at Hillsboro, N. H., by 1AHF. 250 miles on a spark coil is certainly fine work.

Mr. Wesley Robinson at St. Mary's, Ga. is regularly copying Avalon-Long Beach phone. The first time we have heard of anyone in the east copying it direct.

8XV at Edgewood, Penna., was reported by 6OM of Los Angeles on Jan. 14 and Jan. 20th.

2BEK of Manasquan, N. J., using one 5-watt tube with but 90 volts of B battery on the plate, has been logged several times at 9IN, approximately 900 miles from Manasquan.

2GK heard 6ZA and has confirmed the reception on Jan. 8th. 6ZA used two fifty-watt tubes with an antenna current of 3.8 amps.

It is a well established fact that a C.W. transmitter using A.C. plate supply or poorly filtered rectified A.C. causes considerable local QRM. This of course modulates the C.W. output and for various reasons can be heard over a very broad range of wave lengths within a limited distance. It would be mighty convenient to be able to measure this apparent decrement inasmuch as it is quite a factor in local QRM restrictions. Can anyone furnish any enlightening information on this subject?

5ZQ, ex 5PG, is a new station in Oklahoma. His QRA is W. H. England, Ponca City, Okla.

The old Fessenden 100-kilowatt 500-cycle

synchronous set at NAA has developed trouble in the generator and has not been in use for some time. A 35 kilowatt Telefunken 500-cycle quenched transmitter is being used and it is believed that if it shows itself satisfactory the big old stand-by will be dismantled. The 35 kilowatt set was the one in use at Old Sayville before the war. The antenna current is slightly higher than with the 100 kilowatt set, being around 100 amps. on the present 2650 meter broadcasting wave. Reports indicate that the signals are being heard just as good as with the smaller set but a very peculiar note has been noticed. A tube set has been tested out but no information is available at this time.

1ZE says if you will hook a husky variable condenser across the high-frequency side of your magnetic modulator and tune it down till your antenna current falls off one half, you will eliminate A.C. or D.C. noises and modulate 100 per cent. more volume.

Mr. J. C. Ramsey, 1QR has recently obtained an experimental license for special work under the call of 1XA. Some very interesting work is being carried on and some of the results will be mentioned at an early date.

Most of these would-be news reporters get their tongues twisted when they start thinking of radio. One reporter mentions that the stations instruments were tuned at about 60 meters and that that meant they were tuned to be most receptive to atmospheric disturbances at a distance of 60 meters above the earth. Maybeso!

Some of you fellows that are particularly adept with the pen scratch off a few cartoons and send them into the QST factory.

Someone asked us the other day if the 20 Mule Team borax in a chemical rectifier was to put the kick in it. We replied that that must be where the kick comes from when you get hold of it.

3XM at Princeton, N. J., has recently had a very serious fire, destroying the transmitter completely and a good share of the receiving apparatus. Mr. Richardson informs us that 3XM will not be in operation until next fall. Fortunately no one was injured in the fire, which occurred in the building while the set was in operation. We are sorry to lose 3XM, as it was one of the active third district stations.

Farmer to 1ZE: "Did you get all the rock out down at your place Don't hear any more blatin'".

1ZE: "Blasting—oh—you mean my old coffin spark outfit—ha—I've got some TNT in bottles now".

San Fernando, California, possesses one of those real outsiders that have the interest of Citizen Radio at heart. Willis A. Rowe, who runs a garage, charges the storage batteries of most of the gang there free of charge. A Willis A. Rowe would be a welcome man in most every town.

## WESTINGHOUSE BROADCASTING NEWS

*(Concluded from page 58)*

from KDKA. Interest in the programs became so great that in the latter months of 1921 there came to the company an insistent demand on the part of "listeners-in" that they be informed "in advance" of the programs to be broadcasted from KDKA. With this demand—good-naturedly given, yet insistent—"Radio Broadcasting News" was born. Today, with only a few issues off the press, it is a fixture. It has come to stay because public opinion has demanded it. The birth of this newspaper marks one of the many great forward steps in the marvelous history of the advancement of radio broadcasting.

Radio developments are the chief items published in "Radio Broadcasting News," which derived its first circulation list from those friends of radio broadcasting, who, after "listening in" on the KDKA programs, wrote to the Westinghouse Company expressing appreciation of the broadcasting service.

The publication gives in word and picture news concerning various broadcasting programs and pictures of artists who entertained radio enthusiasts. A feature of each issue is the program to be broadcasted nightly during the week following the date of issue of the newspaper. Copies will be sent to all persons desiring to receive the newspaper who send their names and addresses to the Editor, "Radio Broadcasting News," Department of Publicity, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

## A. L. GROVES

*(Concluded from page 55)*

member when he wasn't trying to figure out the purpose of the little green glass bottles on the poles. After such a notable career he spent several years on his father's farm and finally went to work at Brooke as a telegraph operator in October, 1906, where he has remained ever since. In 1910 a Mrs. Groves appeared on the scene and there are now a couple young Groves' to listen to the radiophones.

In July of 1912 he thought he had completed his first station but found that he was badly mistaken and doesn't seem to have accomplished that yet. A "1500 meter" loose coupler and a crystal detector were the main features and the won-

derful feats of hearing time signals from Key West and copying the west coast naval stations were finally accomplished. Sometime later he picked up the phones and heard a flock of amateurs pounding away and thought it was the usual 600 meter commercial traffic but discovered there were such things as amateurs and thereafter camped on the low waves and became a full fledged amateur, copying middle-west stations, which was a wonderful achievement in those days. Since such early days his station has been a continually changing one, for the better or worse, on first the long and then the short waves,—and he is still at it.

We are indebted to Mr. Groves for much valuable information on honeycomb coil reception on both long and short waves. His well known single-layer coils are in use in many stations today and have frequently accomplished noteworthy receiving records.

In addition to the above qualifications he is an ardent A.R.R.L. supporter and a frequent contributor to QST, wherein many of his articles on receiving have appeared.

## F. A. HILL

*(Concluded from page 55)*

radio supervisor at Norfolk and radio supervisor at Savannah, where this narrative now finds him.

We don't know just how long ago Mr. Hill started to think about radio but he makes mention that his thoughts ran along that line before returning from the East in 1914 so we can see that he has been with the game a long time and is considered one of the old timers at it. He says that he is addicted to late hours and will probably pass out of this life with the phones on.

4GL has made itself heard over many thousands of miles and is one of the best known 4th District C.W. stations. Ships over a thousand miles west of Portland, Oregon, have reported 4GL during favorable conditions and his twitter has been copied in the Atlantic over two thousand miles out from Savannah. Mr. Hill's fist is well known and one needs to only hear a few letters from him to identify it. To our knowledge there isn't a man that can count fast enough to tell how many words a second he sends. 4GL handles a lot of traffic monthly with 8ZY of Washington and is one of the best traffic handlers of his district. The 8ZY-4GL combination can be heard almost every night ripping them off at top speed. No wonder they call him "Chain-Lightning Hill!"

Mr. Hill has recently been elected on the Board of Direction of the American Radio Relay League and we know will be a mighty valuable man in that capacity.

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Lower Wavelengths

Ingersoll, Ont.

Editor, QST:—

There has been a great deal said regarding lower wavelengths, but to the best of our knowledge very few amateurs have taken the matter to heart. We are therefore taking this opportunity to outline our personal experience as regards operation below 200 meters.

3GN uses a  $\frac{1}{2}$  K.W. Thordarson, 25 cycle, oil immersed plate glass condenser, O.T. of three inch ribbon, and a specially constructed non-sink gap. A new gap is in the course of construction, having teeth three inches in width but otherwise identical with the gap now in use.

When 3GN was first put in operation a modified Round's ground was employed. The wavelength was 192, and radiation from 2 to 2.5 hot wire amperes. It was at once apparent that the apparatus was not doing its best, and improvements were at once commenced.

A counterpoise was erected and used exclusively instead of the ordinary ground. The wavelength was 170 meters, and at the end of five hours testing and adjusting, the reading was 2.7. Then more insulators were used in the counterpoise, leads shortened, and this followed by still more adjustments. Within a week's time the reading had reached 3.0 then 3.2 and finally 3.5. Under ideal conditions we have been able to get a reading of 4.6 to 5 amps., though we now run between 3. and 3.5. All these readings were taken with seven inch coupling, and using an Eldredge Meter. the wavelength, as stated above, was 170 meters.

From the above it is evident that quite as good work is possible on wavelengths below 200 as is being done on 200 and over. However, the low wavelength has a decided disadvantage, which in our opinion it is up to the manufacturers to correct when designing receivers. The radiated wave of 3GN is very sharp, being practically inaudible on 360 meters at a distance of five blocks, even when a four step amplifier is used. In consequence the receiver must of necessity be able to tune efficiently to 170 meters or we are not heard. Apparently there are a great many who are unable to tune this low, or else

do not trouble to listen in on this wavelength believing it is dead.

We do not mean to say that all, or in fact any, of the receivers now on the market are not capable of tuning to 170 or less. We do find however that they are not being built for as efficient operation on 140 to 170 as they are from 170 to 250. This is doubtless natural, because so very few stations are working between 140 and 170 meters.

We therefore believe that the answer to the more general use of lower wavelengths lies with the manufacturers of receivers, and especially the prominent advertising of the sets themselves. We shall watch for developments with much interest.

Everyone is aware of the fact that very few spark stations are working below 180 meters. Consequently there is a minimum of QRM and the use of these lower wavelengths offers a new field for amateur communication. It would certainly avoid so much jamming on 200 meters: and need we also mention the little point of keeping within the law?

A few days ago we received a letter a most sarcastic and disparaging letter, from a certain flying officer located some one hundred miles away. He informed us in no uncertain terms that we were on 360 meters because we seriously interfered with phone reception from KDKA. Now we take pride in the fact that we have been able to get good results on 170 meters, with a very low decrement, and consequently we were at first incensed at what appeared to be a deliberate falsehood. However upon considering that he was quite evidently new to the game we decided to look into the matter and find out where the trouble really lay. We verified the wavelength and decrement, and then began inquiries. What we have found out will likely be of interest to the Westinghouse people.

Mr. Gowan, of Kitchener, has already noted that KDKA has a double wave, or perhaps to be exact a harmonic. We have verified this report, and several local amateurs have noticed the same thing. This second wave or harmonic is on 170 meters or else very near it, and the flying officer above mentioned made an error in his conclusion that it was 3GN who was on 360 meters.



For our peace of mind we would like to hear from the Westinghouse people, as the second wave or harmonic is more than audible, and we haven't the time to explain the thing to every would-be amateur who thinks he has something to complain about.

Thanking you for your valuable space, we beg to remain

Very truly yours,

H. R. Byerlay, 3GN.

### Cages vs. Flattops

1814 East First St.,  
Duluth, Minn.

Editor, QST:—

In the article in the January QST describing the antenna system at 3DH, Mr. Richardson states that the current in the conical cage antenna is divided evenly among the six wires, "whereas, if a flat top were used, approximately 60% of the energy would be found in the two outer wires." He also says that the cage aerial gives better results than the aerial used previously. He implies that the superior efficiency of the cage aerial is due to the uniform distribution of current, but a little figuring will show that it cannot be. A six wire flat top aerial having 60% of the current in the two outer wires would have about 33% higher resistance than an equivalent cage the resistance referred to is that of the horizontal portion only, without leadin or counterpoise). If two aerials, one a flat top and the other a cage, consisted of six wires of No. 12 copper 50 feet long, the h.f. resistances would be approximately .166 ohms and .125 ohms respectively. If the current in the leadin was 2.5 amperes (250 watts input in a 42 ohm aerial) the mean value of the current in the horizontal portion would be between 1.5 and 2.0 amperes. Taking the larger value, the resistance loss would be .666 watts in the flat top and .500 watts in the cage. A grand total of one-sixth of a watt is saved by the cage antenna!

With an input of 250 watts, the antenna at 3DH radiates 80 watts and dissipates 170 watts in the form of resistance and dielectric losses, according to data given by Mr. Richardson. Therefore the conical cage antenna is .1% more efficient than a flat top antenna of the same dimensions.

The symmetrical arrangement of the wires in a cage aerial equalizes their inductances, but it does not equalize their capacities, and so cannot equalize the currents in them. The only way to make the currents absolutely equal would be to build a cylindrical counterpoise, and put the cage aerial at the center of it. A better plan would be to build a flat top aerial with small wire in the middle and large wire at the edge, the size of each wire being proportional to the current it carries.

I have no quarrel with anyone who makes a cage leadin, as that form has lower resistance than the usual loosely twisted bunch of wires; but I believe that a man who builds a cage aerial is wasting his time.

Sincerely yours,

R. A. Braden.

(Hop to it, fellows—let's have it out and learn what we really think is best—Ed.)

### Re Our January Editorial

New York City

Editor, QST:—

I cannot but take exception to the attitude expressed in your editorial headed Excelsior in the January QST. I do not know who the "eminent radio engineer" mentioned may be, but he cannot be very eminent if he made the remarks credited to him. This is shown in part by the fact that Mr. Edwin H. Armstrong, one of our best radio engineers, has given a great deal of time and effort to putting the amateur Transatlantics across, which he would have been hardly likely to do, had he thought there was no chance of success. Everybody knows that exceptional distances on extremely small powers can be obtained under certain conditions. It must be remembered that the first transatlantic, to Glace Bay, was carried on with an actual radiated energy of a few hundred watts in conjunction with an untuned crystal receiver. The editorial in question gives the impression, which I can hardly believe to be true, that you do not differentiate between amateur service and commercial service. Transatlantic commercial service, to compete successfully with the cables, must of course give twenty-four-hour-a-day service three hundred and sixty-five days a year. Any real radio engineer will tell you that in long distance transmission, the power required for continuous service may be several thousand times the power necessary to get through under "decent atmospheric conditions," to quote your article.

One of the writer's stations, WSA, has on several occasions worked ships at 5000 miles, yet would you yourself install a 10 K.W. synchronous transmitter operating on 600 meters for commercial service over this distance? Do you suppose Dr. Alexander-son would have allowed the Radio Corporation to spend several million dollars at Port Jefferson if the same results could be obtained with six 5-watt tubes and a dozen pieces of 2x4? Also do you imagine that the best of the short wave stations that got across could handle much traffic in the average August mid-day?

I do not for one moment wish to belittle a splendid achievement, but I do object, and I think justly, to the attitude that radio amateurs have done something con-

sidered impossible by radio engineers of standing.

Let me emphasize once more that the commercial radio engineer is interested in general in twenty-four-hours-a-day service, while the amateur is, naturally, interested primarily in working the greatest distance under the extremely limited conditions as to power and wavelength which he is allowed. The radio engineer who states that communication cannot be obtained under the conditions of your transatlantic test is not worthy of the name of radio engineer, nor is the amateur who says that such communication is practical, money-making commercial communication, worthy of the honor of being called such.

Very truly yours,

Bowden Washington

Chief Engineer,

Independent Wireless Telegraph Co., Inc.

### Who Is Signing 7AJ?

3015 North 26 Street,  
Tacoma, Washington

Editor, QST:—

Who is the bird in the east who signs 7AJ? I have received reports at 7AJ being heard by seven different men in the east and each time circumstances have proven that it was not the writer's station that was heard.

Several months ago I received a card from 8LX, saying that he, 8CH, 8ASF, and 8LF had heard 7AJ on several occasions. Neither the wave, time, nor tone agreed with mine. About a month ago I received a card from 9BMN, saying that he had heard my C.W. I have no C.W. set. A week ago I got another card from the op at 8YAA and 8AXC, stating that he also had heard my C.W.

I do not think that all these men are at fault, they undoubtedly heard a 7AJ but what 7AJ? Nigger in the woodpile somewhere.

I shall be duly thankful to anyone who can tell me howcum.

Very truly yours

F. B. Mossman, 7AJ.

### Hooray!

DEPARTMENT OF COMMERCE

Bureau of Navigation

Washington, February 2, 1922

Editor,  
American Radio Relay League,  
Hartford, Conn.  
Sir:

This office has received your letter of the 28th ultimo, suggesting that the street addresses of owners of special land stations be published in the "List of Radio Stations of the United States," in addition to the names of the cities in which the stations are located.

In reply this office desires to thank you for the suggestion and beginning with the "Radio Service Bulletin" for this month, which is supplemental to the list of stations, the full addresses of the owners will be published.

Respectfully,

A. J. Tyrer,  
Acting Commissioner.

### Humidity and Fading

209 So. State St.,  
Ann Arbor, Mich.

Editor, QST:

An old timer can hold his peace only about so long and the last copy of QST has lead me to express some of the ideas that I've wanted to get off my chest for a long time!

The immediate cause of this out break is the article of Mr. Jacob Jordan in the December issue. Mr. Jordan's data while most interesting are almost worthless. He has hit, I believe, one of the most important causes of fading. That is to say the fading that is due to the variation of wave length and which may be corrected by retuning the receiver. The other types of fading I believe are not so easily accounted for.

Mr. Jordan does not attempt an explanation of the variation in wave length but I have always believed that this variation was due to the variation of the dielectric constant of the space between the antenna and the conducting layer. In our case it is the water vapor in the air. The dielectric constant of the suspended water vapor would be anywhere between 80 and infinity, depending on how pure the water vapor was. It can easily be seen that the capacity of the antenna would be increased at least 80 times if the space were filled with water; hence the wave length would be increased 900%, other things remaining the same. Isn't it logical to believe that a reasonable amount of water in suspension would alter the wave length a noticeable amount? If Mr. Jordan had given us the absolute humidity instead of the relative humidity I should venture to say that we would find that the change in wave length would vary roughly as the square root of the ABSOLUTE humidity. It is to be understood in the above that I am not trying to explain any type of fading except the type that can be corrected by retuning.

Another point that has interested me was the power factor question. I believe that both parties are right for after all it is just ones point of view. *If one is outside the circuit* and considering the freely oscillating circuit as a whole then I should say that the *P.F. was unity*. On the other hand if we are *within the circuit* and talking about any particular part of it I should say that the *P.F. was approximately zero*.

Here is a point in connection with this that reduces some of the arguments to an absurdity. In an ordinary radio circuit the P.F. is approximately equal to the phase displacement and the decrement is "pi" times the phase displacement or as a very good approximation, Decrement = 3.1416 times Power Factor.

In light of the above do our friends on the Pacific Coast still insist that they want their P.F. as large as possible? If they do they must necessarily demand that their decrement shall be as large as possible. The question is: do they?

If anyone doubts the logic of this I refer them to an article by Dr. Dellinger in the Feb. 1919 issue of The Proceedings of the Institute of Radio Engineers.

There! I feel greatly relieved.

Sincerely yours,

Ross Gunn, B.S.

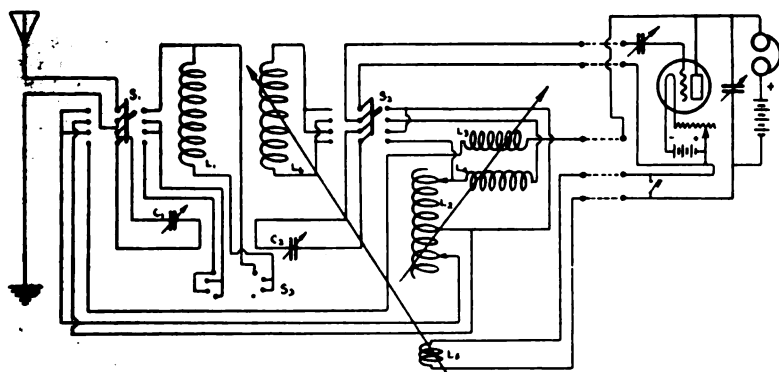
Pre-war 8JA and 8ZO.

### A Combination Tuner

819 Sheridan Ave.,  
Akron Ohio, R #24.

Editor, QST:

Am enclosing a diagram that shows how to combine Mr. J. L. Reinartz's CW tuner with my coil set. Mr. Reinartz's tuner was described fully in the June 1921 QST.



I decided to try the tuner and didn't care to go to the expense of purchasing any new condensers so combined the tuner with my coil set. The diagram is self-explanatory but I will give the names of all the instruments to be sure that everything is clear.

$S_1$  and  $S_2$  are cam (anti-capacity) switches while  $S_3$  is the usual primary condenser switch.  $C_1$  primary condenser and  $C_2$  secondary condenser.  $L_1$  primary coil;  $L_2$  secondary coil.  $L_3$  is the tickler and should be cut out when using the CW set.  $L_4$  is the main CW inductance,  $L_5$  the plate inductance, and  $L_6$  the grid inductance.  $L_3$ ,  $L_4$ , and  $L_5$  are the CW inductances and can readily be made by anyone by following Mr. Reinartz's directions.

The two cam switches should be coupled together so that one knob will work both, having the CW wires, say on the left, and the ones from the coil on the right.

Room can be found on almost any panel for the CW inductances as they occupy very little room. The same can be said of the cam switches so there is no excuse for not having a good CW tuner right in your shack, at very little expense.

Hope that you will find this of some interest

Respectfully yours,  
E. Ulmont Fisher.

### More on Tuning Honey-Combs

Wooster, Ohio.

Editor, QST:

After reading Mr. Jessup's letter in December QST concerning honeycomb tuning it seems to me that he doesn't say as much as he should about primary tuning. It is really quite an art to learn to correctly tune the primary and adjust the primary and tickler coupling on any wave length, CW or spark, and I believe that most of those who think that good work can not be done on honeycombs have never learned to use them correctly.

When the primary is tuned to the same wave as the secondary it is very hard to make the tube oscillate, and it is usually

possible to put the tickler coupling to maximum and with the primary coupling very loose get very sharp tuning and strong regeneration. We will consider the primary and secondary each tuned to 200 meters, and the tickler tightly coupled. With the primary tightly coupled the set will oscillate below 190 meters and above 210. By varying the secondary condenser the station is found which we will consider is on exactly 200 meters. The primary coupling is next loosened, which will increase regeneration. When the primary coupling is very loose the tube will oscillate at all waves, but with a little tighter coupling it will oscillate only below 197 and above 203 meters. The looser the coupling the

narrower the space that the tube does not oscillate and consequently the greater the regeneration and the sharper the tuning. Slight adjustments of the primary condenser may be necessary to keep the primary tuned exactly to the incoming signals.

If the tube oscillated too easily when tuned this way loosen the tickler coupling slightly.

The selectivity of a tuned plate circuit can not be compared with that of a honey-comb circuit that is carefully tuned. An operator who doesn't know just what wave his primary has been tuned to may be surprised to find how small a coil is needed to get the primary down to 200 meters, but even 10 turns in the primary is enough to give ample coupling when the primary is carefully tuned.

If there is no condenser across the tickler a coil of 75 or 100 turns will usually be necessary.

Very truly yours,  
Victor Andrew, 8BPP.

### A Love-Letter

Editor, QST:

Why is it that every Arc Station has to fizz and spit and ding and dong and clong and bang and buzz and bizz and beller and wail and pant and rant and howl and yowl and grate and grind and puff and bump and click and clang and chug and moan and hoot an toot and crash and grunt and gasp and groan and whistle and wheeze and squawk and blow and jar and jerk and rant and jingle and twang and clack and rumble and jangle and ring and clatter and yelp and howl and hum and snarl and puff and growl and thump and boom and clash and jolt and jostle and screech and snort and snarl and slam and throb and crink and quiver and rumble and roar and rattle and yell and smoke and smell and shriek like hell on every wave length from ten meters up to infinity and then can't get their traffic through?

A. Victim.

### A Trip to the U.S.S. Ohio

Editor QST:—

While in Philadelphia a short time ago, I had the honor of visiting the Philadelphia Navy Yard. In the course of the day we went aboard the Navy radio ship the U.S.S. Ohio. At that time I thought it was just an ordinary battleship, but in a few minutes, much to my surprise I found out that it contained a lot of interesting radio apparatus and some interesting radio operators. Walking down one of the aisles, I heard a voice saying this: "When in the course of human events it becomes necessary for IB\*SHIR\*\$&\*! (explosion) and at first I thought it was a school room. You can imagine my surprise when I peeped in the door and beheld

a blond haired fellow in very ragged overalls bending over a piece of apparatus and what he was saying to it would never be found in the Congressional records. It was a startling array of apparatus that greeted my eyes. It appears that this chap, who's name I afterwards found out was Dan-nals, had been working with some kind of a transmitter and it would not 'mote! That was the cause of the explosion. After sitting in the room for a while talking to a fellow by the name of Garrett (who was born on Staten Island of very ancient Dutch parentage) the blond haired one started again; "Four score years and ten ago," ???Z\$C!\*!BF&5 another explosion. By this time the air became very warm and I thought I better move. I then wandered around until I heard the old familiar quenched spark hissing and brave like I started to investigate where it was coming from. Thru a doorway I crawled and behold: what mine eyes seen were enough to make any amateur turn green with envy. Arcs-sparks and gosh only knows what. After straightening up I was afraid to move. All kinds of sets, rubber mats on the floor and a tall, dark haired individual giving orders to some young chaps who seemed busier than a one armed paper hanger with the itch! This tall gentleman's name I afterwards found out to be Manuel and that he was Czar over the spark and arcs. While talking to me he told me that he did not know anything about radio which seemed awful funny to me for his orders seemed to be sensible and the young men working there seemed to know what he wanted done. After he had issued a lot of orders to the future operators about what he wanted done, he escorted me upstairs again to the ships radio room (The first place I walked into) and introduced me to some other men there who were no doubt very important personages for they had a lot of gold braid on their sleeves and walked around like they owned the ship. After listening to WJZ roaring in (only 5 steps) they started a tube set going, which used two small P tubes for puncturing the air. While looking at the ammeter, I saw 13 amperes registering and thought it was out of order or crazy with the heat, but they assured me it was in good health and working O.K. Visions of my one little amp. in the air came back to me. It was just getting interesting when in breezed a fellow with more gold braid than any of the rest and they all saluted with a smile and became very humble in manner so I breezed out before they thru me out. Well this is all I lamped on this visit but when the opportunity presents itself again, I am going to pay them another visit.

Yours 'till the grid leaks

B. B. Attery.

Hi!

East Pittsburgh, Pa.  
February 1, 1922Mr. Harold Hotaling,  
106 Forest Street,  
Gloversville, N. Y.  
Sir:

In reply to your recent card in which you mention the effect of Northern Lights on Radio, I will state that this phenomena never effects radio waves. It usually causes trouble to telephone and telegraph circuits, but so far has not been noted on radio work.

Yours very truly,  
Westinghouse Elect. & Mfg. Co.,  
C. W. Horn,  
Radio Service.

### Lower Wavelengths

Huntington Park, Cal.

Editor QST:—

Concerning the article by Mr. Forant in the Dec. QST about spark coil transmission, how about 150 meters for the work? It would be possible to work thru any sort of QRM on 200 by using this wave. What say?

If some of these transformer hams and the transformer stations that aren't hams would install a spark coil set operated on 150, 175 or even lower waves to do their local work it would reduce the QRM on 200 VERY CONSIDERABLE, besides I want someone to work with down there.

Yours for less QRM  
Frederick J. McClung.  
6ASQ

### Absorption Modulation

Lyndhurst, New Jersey

Editor, QST:—

Of late I have been reading quite a bit about the now famous "1DH hook up" for a small powered phone set, but up to date have not seen anything about getting perfect speech using the absorption loop method of modulation.

I have for the past three months been experimenting with a single tube set as described in August 1921 Issue of QST and find that by having fewer turns in the grid coil and putting it over the main inductance the radiation is greatly increased.

I am at present getting nine-tenths (0.9) of an ampere radiation with 350 volts on the plate; 35 to 45 milliamperes space current and 1.3 amperes at 7 volts on filaments.

For modulating the voice I put a complete turn around the grid coil and attach it to the hand microphone. It seems that the grid coil acts as a transformer when used in this way; there is no loss in radiation as when using the loop around the main inductance and if any loss is noticed

it might be one half of a tenth, but that returns when the transmitter is spoken into.

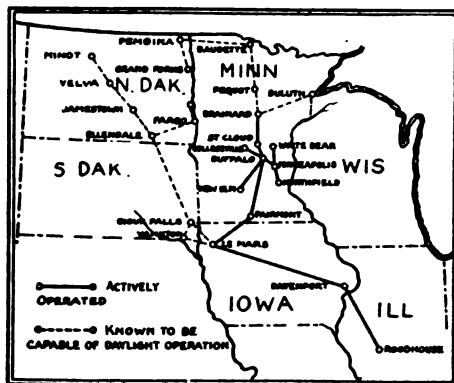
I am using rectified A.C. for high voltage, using an old transformer with a split winding and an electrolytic rectifier.

Stations 20 to 25 miles away tell me that there is no hum, or in fact, anything that might distort the voice.

Yours respectfully,  
Fred Suefert, 2AOG.

## A Storm Relay Route

**D**URING the latter part of February a terrific ice storm and blizzard passed over Minnesota and the adjacent territory and completely destroyed all of the wire communication connections of Minneapolis and St. Paul with the outside world. Amateur radio came to the rescue and established a remarkable network throughout the district and restored communication with the outside world.



All wire service went out on the evening of February 22d at 6 p.m. The "Minneapolis Tribune" appealed to 9XI, University of Minnesota, to get news for its morning issue and to make an attempt to get in communication with the outside world. Accordingly 9XI fell to and succeeded in raising 9ZJ in Indianapolis thru terrific QRN, but before any copy could be secured from Indianapolis he was forced to break off due to increasing atmospheric conditions. At 2:00 a.m. 9XI was in communication with 9AXF at Chicago but before any traffic could be handled, the Associated Press had gotten a line through to Chicago, via Vancouver, Denver and St. Louis and were handling their traffic over that roundabout route. This line too went out early in the morning and the entire A. T. & T. service with it. The telephone people set out to repair the lines immediately but requested that some of the Minneapolis and St. Paul stations get in touch with  
(Concluded on page 75)

# Calls Heard



## HEARD DURING FEBRUARY

### Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instruction.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the C.W. stations.

#### W. E. Clyne, Cristobal, C. Z.

Spark: 5MI, 5XU, 5ZA, 9YC.

C.W.: 1AZW, 1BDL, 1BKQ, 2CCD, 2XI, 3FS, 3HG, 3ZY, 4CO, 4ID, 47E, 5ZAA, 8BEP, 8BUM, 8AGZ, 8CLD, 8ABV, 8WB, 8GV, 8AXK, 8XK, 8AIM, 8XV, 8ZZ, 9AL, 9AYS, 9DCF, 9FM, 9NX, 9PS, 9XAQ, 9ZAC, 9ZL.

#### Can. 3JL, Toronto, Ont.

C.W.: 1FB, 1IN, 1PT, 1QN, 1QP, 1QR, 1QZ, 1TH, 1UN, 1XA, 1ZE, 1AAP, 1AFV, 1AGI, 1ARY, 1AVI, 1AWB, 1AZW, 1BCF, 1BEA, 1BEP, 1BES, 1BFU, 1BKQ, 1BUA, 1BWJ, 1CKE, 1CIK, 1CIT, 2BB, 2BG, 2CT, 2EH, 2FF, 2OF, 2SQ, 2VA, 2VH, 2AER, 2AJF, 2AKO, 2ALR, 2AMO, 2ANZ, 2AWA, 2AWF, 2BBB, 2BCF, 2BEA, 2BEB, 2BCH, 2BLT, 2BNZ, 2BRC, 2BUW, 2CCU, 2IBZ, 3BG, 3CA, 3CG, 3FR, 3FS, 3HG, 3HJ, 3IZ, 3KM, 3NH, 3RD, 3RF, 3SQ, 3YQ, 3ZO, 3ZY, 3AA, 3AD, 3ADT, 3AHK, 3ANL, 3ANY, 3APA, 3APQ, 3BEC, 3BFU, 3BLF, 4BK, 4BQ, 4EU, 4EW, 4FT, 4GL, 4ID, 4FV, 5IX, 5NZ, 5AC, 5CG, 5CI, 5HJ, 5IQ, 5IR, 5JS, 5JU, 5LW, 5NB, 5NI, 5OA, 5OH, 5OS, 5PX, 5QM, 5QY, 5SP, 5UK, 5VK, 5WR, 5XK, 5XV, 5ZG, 5ABO, 5ACF, 5AHK, 5AFN, 5AGI, 5AID, 5ALB, 5ANJ, 5AOB, 5AOG, 5ARI, 5ARU, 5ARW, 5ASV, 5AUO, 5AWP, 5AWY, 5AWZ, 5AXC, 5AXK, 5AXO, 5AYZ, 5BBK, 5BDO, 5BFX, 5BLW, 5BMA, 5BNY, 5BOX, 5BQF, 5BQL, 5BUM, 5BWH, 5BZY, 5CAG, 5CAH, 5CAV, 5CAZ, 5AGT, 5CLN, 5ZAE, 5EA, 5HK, 5IU, 5JL, 5KP, 5LE, 5LQ, 5LT, 5US, 5WK, 5WO, 5XM, 5ZG, 5AAS, 5AAY, 5AEJ, 5AFH, 5AIV, 5AJA, 5AJH, 5AJP, 5AKD, 5AKR, 5ALS, 5AMU, 5ARK, 5ASB, 5AWM, 5BJB, 5BRL, 5DAM, 5DTJ, 5DTS, 5DYN, 5YAM. Can. 2BG, 3SJ.

Spark: 1AW, 1CK, 1CZ, 1RV, 1ADC, 1ARY, 1BDT, 1BHO, 1BOQ, 1BVB, 1CHJ, 2BK, 2BM, 2BY, 2CI, 2EL, 2FD, 2JU, 2KM, 2OM, 2SZ, 2TS, 2WY, 2ABM, 2ACW, 2AHU, 2AWF, 2AXK, 2BTJ, 2CIC, 3AC, 3DM, 3HG, 3QP, 3UD, 3VS, 3XM, 3AIC, 3AJD, 3AQH, 3ARM, 3ARN, 3AUW, 3BJT, 4BQ, 4EA, 4GN, 4CP, 4FA, 4FS, 4JJ, 4KY, 4LB, 4LI, 4NO, 4NZ, 4SQ, 4RQ, 4SP, 4TT, 4UC, 4WO, 4XE, 4ADO, 4AFB, 4AFG, (4AHQ), 4AGK, 4AHQ, 4AHS, 4AID, 4ATO, 4AJT, 4AK, 4AMZ, 4AOT, 4APB, 4ASL, 4AVT, 4AUE, 4AWP, 4AXX, 4BAC, 4BAZ, 4BFH, 4BOF, 4BYP, 4CAY, 4CBJ, 4AV, 4BP, 4CP, 4JQ, 4TO, 4UH, 4VL, 4YB, 4YQ, 4ZJ, 4AAP, 4AGR, 4AIS, 4AMS, 4AZE, 4DIW, 4DWP. Can. 3BA, 3GN.

#### Can. 2DK, Sutton, Que.

Sparks: 1AAX, 1ADC, 1ADL, 1AEV, 1AFZ, 1AHH, 1AHL, 1AIT, 1AKC, 1APO, 1ARY, 1ASF, 1ASZ, 1AZK, 1AZW, 1BCF, 1BEP, 1BES, 1BGC, 1BHR, 1BIR, 1BLE, 1BJE, 1BJS, 1BQL, 1BRQ, 1BTL, 1BVH, 1CHJ, 1CK, 1COK, 1DZ, 1GM, 1HK, 1IA, 1LZ, 1QD, 1QP, 1RV, 1SD, 1SN, 1UN, 1YB, 2AID, 2AXX, 2ARB, 2AER, 2AIM, 2ARM, 2AAF, 2AWF, 2ABM, 2ARK, 2BM, 2BQ, 2BSC,

2BBN, 2BK, 2BJO, 2BY, 2CHJ, 2DA, 2EL, 2FP, 2JZ, 2JU, 2OM, 2OO, 2TU, 2XM, 2XK, 3AQR, 3BFU, 3CG, 3DH, 3DM, 3FO, 3HG, 3HJ, 3XM, 3UC, 3YP, 3ZO, 4EA, 5ZA, 8ACF, 8AFA, 8AFS, 8AMB, 8AMZ, 8APE, 8AXO, 8AYN, 8BFX, 8BUM, 8CG, 8RC, 8TC, 8NL, 8VW, 8XE, 8XA, 8XG, 8ZA, 8ZG, 8ZO, 8ZP, 8YB, 8YC, 9ZN.

C.W.: 1ARY, 1ASF, 1AVR, 1AYL, 1AXI, 1AZW, 1BDI, 1BEA, 1BES, 1BKQ, 1BQL, 1BRQ, 1BSD, 1BWJ, 1BWP, 1CAK, 1CGS, 1CLZ, 1EZ, 1IN, 1QF, 1QN, 1QP, 1PT, 1RD, 1RZ, 1TS, 2AAB, 2AKO, 2AWL, 2AYV, 2BFZ, 2BJO, 2BSC, 2BYW, 2CBT, 2FP, 2ADX, 2AQR, 2CC, 2FS, 2HJ, 2GC, 2ZO, 2ADG, 2AGZ, 2AWY, 2BMA, 2BUM, 2JS, 2JU, 2ZZ.

#### Can. 3GG, Timmins, Ontario

1AWB, 1ARY, 1AYW, 1BDI, 1BUA, 1BWY, 1IO, 1MX, 1TS, 1XM, 2AAB, 2BAK, 2BEJ, 2BTJ, 2BFX, 2CBG, 2FP, 2QL, 2TS, 2VA, 4ID, 4FT, 5UU, 5FV, 5ASB, 8AIM, 8AWY, 8AXK, 8AQH, 8APT, 8ALV, 8AUO, 8AIZ, 8BU, 8BFX, 8BBK, 8BEF, 8BUQ, 8BZY, 8BDO, 8BOX, 8BK, 8CP, 8CBR, 8CGM, 8EA, 8FA, 8HJ, 8KP, 8NI, 8PX, 8RH, 8SP, 8TK, 8UK, 8UC, 8VY, 8YV, 8ZG, 8AIV, 9AF, 9AKF, 9AGR, 9AJB, 9AAV, 9ATM, 9AY, 9BED, 9BJV, 9DBQ, 9DFX, 9DV, 9DZQ, 9DNT, 9DZY, 9DWP, 9DKV, 9DXT, 9EA, 9GK, 9IO, 9IV, 9KP, 9LW, 9LE, 9OL, 9QE, 9TV, 9UL, 9VL, 9WK, 9YQ, 9YAK, 9YO, 9YB, 9YC.

#### 3IL, Kingston, Ont.

C.W.: 1AAD, 1AFV, 1AGI, 1AJS, 1APP, 1AVI, 1AWB, 1AYL, 1AZW, 1AZK, 1ADC, 1BDI, 1BEA, 1BES, 1BH, 1BHO, 1BJH, 1BJO, 1BKQ, 1BKE, 1BOQ, 1BQE, 1BRQ, 1BSD, 1BSN, 1BTL, 1BUA, 1BYK, 1BWJ, 1CAK, 1CIK, 1CIT, 1CMK, 1CQO, 1EZ, 1IN, 1QP, 1RD, 1TS, 1WT, 1XM, 1ZE, 2AAB, 2AJF, 2AJP, 2AL, 2AQF, 2AWL, 2AWS, 2AYF, 2AYV, 2BBB, 2BB, 2BEA, 2BEE, 2BEH, 2BGH, 2BML, 2BYT, 2BNZ, 2CAV, 2CC, 2CCU, 2CGO, 2FP, 2HI, 2JW, 2KP, 2NQ, 2NZ, 2OG, 2SQ, 2AQR, 2AFB, 2AI, 2AJD, 2AL, 2AP, 2ADI, 2BEC, 2BG, 2CZ, 2CC, 2FS, 2HJ, 2HG, 2HR, 2SQ, 2EW, 2GL, 2HC, 2JJ, 2IN, 2ADJ, 2AP, 2AGZ, 2AIM, 2AIO, 2AJO, 2AQF, 2AQR, 2AWN, 2AWZ, 2AXY, 2BEF, 2BFX, 2BK, 2BNY, 2SEJ, 2XK, 2XV, 2XXF, 2YV, 2AKR, 2AIV, 2AJP, 2BRL, 2BXH, 2BY, 2CFP, 2ED, 2EM, 2HJ, 2NI, 2ALS, 2AZ, 2ADG, 2BET, 2BV, 2BEJ, 2HA, 2IO, 2NL.

Spark: 1ADL, 1ADP, 1FZ, 1AKZ, 1APJ, 1ARY, 1BJE, 1BOQ, 1CZ, 1EA, 1NZ, 1RV, 1ZP, 2ARD, 2ARK, 2ACW, 2AHU, 2AJW, 2BAW, 2BNZ, 2BW, 2BOY, 2FP, 2OM, 2QW, 2RP, 2TJ, 2UH, 2XK, 2ZW, 3ARM, 3DM, 3EM, 3FB, 3GM, 3HJ, 3TA, 3UQ, 3AFY, 3AK, 3AKQ, 3AI, 3AJ, 3AWP, 3BO, 3BU, 3BX, 3TE, 3XE, 3XM, 3AET, 3AM, 3AGR, 3BP, 3BHR, 3DW, 3KI. Canadian (3HE), 3HF, 3HN, 3NE, 3KG.

#### Can. 4CB, Morse, Sask.

Spark: 5BY, 5FM, 5FO, 5IF, 5KI, 5MK, 5XB, 5XU, 5YG, 6APH, 6ATQ, 6AWH, 6BIG, 6IC, 6SJ, 6QR, 6XH, 6ZAM, 7BD, 7BS, 7CC, 7CD, 7CK, (7EX), 7GD, 7GJ, 7HW, 7IY, 7JD, (7LY), 7ME, (7MP), 7NR, 7NZ, 7OT, 7TJ, 7WG, 7XA, 7XB, 7YA, 7YG, 7YJ, 7YL, 7ZJ, 7ZM, 7ZO, 7ZP, 7ZT, (7ZU), 7ZV, 9AAP, 9ABV, 9ACB, 9AFZ, 9AGN, (9AIG), 9ALP, 9AMU, 9ANF, 9DWF, 9ARZ, 9ATM, 9AUF, 9AUZ, 9AVC, 9AVS, 9AVZ, 9AWR, 9AYW, 9BBM, 9CA, (9DEH), 9DEW, 9DEG, 9DKG, (9DOC), 9DNC, 9DSD, 9DZQ, 9EX, 9HI, 9HT, 9INF, 9ISM, 9LW, 9MR, 9NR, (9PT), 9PW, 9RY, 9SA, 9SY, 9TI, 9TY, 9UU, 9WI, 9XI, 9XV, 9YAJ, 9YB, (9YAK), 9ZX. Can. 4AC, (4AO), (4BV), 4DN, 4EI, 9BD.

C.W.: 4BQ, 4FT, 4ZE, 4BY, 5AAM, 5PU, 5ZA, 5ZX, 6AAT, 6AIF, 6APE, 6ASV, (6AWT), 6EN, 6KA, 6KS, 6XAD, 6ZA, 6ZAM, 6ZF, 6ZZ, 7AWS, 7ABS, 7HW, 7JD, 7LU, 7NF, 8CLD, 8LY, 9AAO, 9AAV, 9ADO, 9AJA, 9AJF, 9AJH, (9AJP), 9AJR, 9AKB, 9AKR, 9ALS, 9ALU, 9AM, (9AMB), 9ANS, 9AS, 9AUL, 9AVA, (9AWM), 9AXA, 9AXF, 9AYS, (9BBF), 9BIZ, (9BJI), 9BJV, 9BSG, (9BVY), 9BTT, 9BUG, (9DCF), 9BD, 9DFA, 9DGI, 9DJM, 9DKY, 9DNG, 9DOF, 9DQM, 9DSW, 9DTH, (9DTM), 9DTS, 9DTW, 9DUN, (9DVA), (9DZQ), 9EA, 9EE, 9FM, 9JL, 9KP, 9LJV, 9NG, 9NN, (9NX), 9OO, (9PI), (9PS), 9URI, 9WD, 9XAV, (9XAQ), (9XI), 9XJU, 9YG, 9YS, 9ZAC, (9ZAF), 9ZE, (9ZIF). Can. (9BD).

1DZ, Medford, Mass.

Spk.: 1CE, 1II, 1QO, 1YB, 1ADL, 1ARY, (1BCF), 1BOQ, 1BRQ, 1BSZ, 1BVV, 2BB, 2BM, 2EL, 2GK, 2JZ, (2OM), 2PF, 2RD, 2SR, 2SZ, (2TF), 2TS, 2TU, 2WB, 2ABM, 2AHU, 2AJE, 2AQE, 2ARK, 2AXK, 2BCF, 2BJO, 3CN, 3EL, 3FB, 3FO, 3FP, (3HJ), 3GP, 3JZ, 3KG, 3OU, 3RL, 3PB, (3TA), 3UC, (3UD), 3UQ, (3XM), 3ZO, 3ABB, 3AQH, 3ARM, 3AXK, 3BFU, 4BY, 4IE, 4ZD, 5BY, 5PY, 5CH, 5EO, 5JJ, 5LB, 5LQ, 5OE, 5OU, 5PL, 5RQ, 5UC, 5WQ, 5XE, 5XF, 5YV, 5ZW, 6AFG, 6AJX, 6AMD, 6AOS, 6AGF, 6APB, 6AVR, 6AXC, 6AXO, 6AXK, 6AWP, (6AYN), 6BUM, 6AVR, 9OC, 9EZ, 9ACB, 9DCX.

C.W.: 1PT, 1QJ, 1QP, 1ZE, (1BES), 1BDI, 2PZ, 2VA, 2AHF, 2AJE, 2AKF, 2AWL, 2BEB, 2BRC, 3FM, (3HJ), 3ZY, 3ALN, 3AQR, 4FT, 4GL, 4ID, 4ZE, 5AN, 5FV, 5BK, 5GY, 5IB, 5JM, 5OS, 5VY, 5XV, 5AGZ, 5AIN, 5AQF, 5AWP, 5AXM, 5BAE, 5BDK, 5BUM, 5CIA, 5CLD, 5LE, 5WC, 9AJA, 9ALS, 9BRL, 9BSG.

1CMK, Holyoke, Mass.

C.W.: 1AGI, 1ARY, 1AZW, 1BEP, 1BDC, 1BDI, 1CZL, 1BUA, (1BFU), 1BWJ, (1II), 1XM, (1QP), 2AWL, 2AWF, (2AAB), (2BNZ), (2AQU), 2AFP, (2AYV), 2AJF, 2AYI, 2AGE, 2EL, 2BB fone, (2BB), 2CCL, 2BTJ, (2ALU), (3CG), (3BIY), (3AJD), (3BLF), 3AQR, 3BG, 3AIG, 3HJ, 3ZO fone, 3EL, 3ZAB, 3VW, 3EM, 3ASO, 3SQ, 3VS, 3IL, 3ALN, 3APQ, (4ID), 4DC, 4AZ, 4GL, 4DB, 4CO, 5FV, 5EK, 5ACF, 5AQV, 5ADG, 5BBK, 5ACX, 5TB, 5AOA, 5AGZ, 5AWP, 5XAE, 5CAZ, 5CFP, 5QM, 5BXH, 5AXK, 5LF, 5KS, 5AWM, 5EO, 5ARW, 5TB, 5NB, 5LQ, 5IO, 5KP, 5ALS, 5DW, 5WK.

1CIK, St. Paul's School, Concord, N. H.

C.W.: (1AET), 1ALV, 1ARY, (1AWB), 1AZW, 1BDI, 1BEA, 1BEP, (1BES), 1BIR, 1BJS, 1BOI, 1BOQ, 1BQE, 1BUA, 1CNF, 1II, 1IN, (1OE), 1OT, 1PT, 1XM, 1ZE, (2AAB), 2ABM, 2AJA, (2AJF), 2AJW, 2ALD, 2ANZ, 2AMO, (2AQH), 2AWK, 2AWS, (2AYV), 2AZF, 2AZZ, 2BEB, 2BEF, 2BEH, 2BG, Can. (2BG), 2BND, 2BNZ, (2BRB), 2BTJ, 2FP, 2IPD, 2KP, 2KW, 2SQ, 2TS, 2VA, 2VH, (2XK), 3AAD, 3AAK, 3ADE, 3AFZ, 3AHU, 3AIC, (3ALN), (3AJD), 3APD, 3AQH, 3AQR, 3BAG, 3BD, 3BEC, (3BG), 3BHL, 3BLF, 3BZ, 3CC, 3CO, 3CAA, 3DY, 3FS, 3HJ, (3KM), 3KW, 3MO, 3NH, 3QY, 3QV, (3RW), (3SJ), 3XE, (3ZO), 3ZY, 4BY, 4GL, 4ID, 5FV, 5U, 5AFG, 5AGZ, 5AHK, (5AIM), 5AGT, 5ALD, 5ANJ, (5AOA), 5AQF, 5AQV, 5AWP, 5AWW, 5AWZ, 5AXK, 5BAE, 5BFR, 5BFX, 5BK, 5BNJ, 5BNU, 5BNY, 5BRL, 5BT, 5BTO, 5BK, 5BZY, 5CG, (5HT), 5LB, 5LF, 5LG, (5NI), 5OS, 5OW, 5PX, 5QM, 5TB, 5UD, 5UK, 5VY, 5WE, 5ZG, 5AAV, 9AJA, 9AJH, 9AKD, 9BRL, 9DAX, 9DY, 9HY, 9KP, 9PS.

Spark: (1ADL), 1AHF, 1BKN, (1CZ), (1OE), 2ABM, 2AHU, 2BJO, 2CES, 2CHE, 2OM, 2PR, 2TS, 2QW, 3AIC, 3APD, 3ARN, 3DM, 3OM, 3OU, 3TA, (3UC), 3UQ, 3AFG, 3APB, 3AXX, 3LB, 3SP, 3BHV.

1NY, Belmont, Mass.

C.W.: 1DH, 1FB, 1PD, 1PO, 1PT, 1RD, 1ZE, 1AJG, 1APP, 1ATW, 1AVR, 1AYD, 1BDI, 1BDS, 1BES, 1BKQ, 1BKR, 1BWJ, 1BYG, 1CGG, 1CLZ, 1COC, 1COD, 1CRA, 1CRW, 1CSM, 2AAB, 2AFP, 2AJF, 2AWL, 2AQV, 2AYV, 2BGM, 2BJO, 2BNZ, 2BRC, 2BTJ, 2CCD, 2CGB, 2FF, 2FD, 2FP, 2LO, 2SQ, 2WT, 2PZ, 3CM, 3CZ, 3EM, 3FS, 3RW, 3UC.

3XM, 3ZO, 3ZY, 3AAG, 3ADX, 3ALN, 3AQR, 3BER, 3BFU, 3BLF, 3BNU, 4BY, 4GL, 4ZE, 5AW, 5FV, 5U, 5OS, 8QM, 8VY, 8XV, 8PX, 8ZG, 8ZZ, 8AHS, 8AIM, 8AIO, 8AGZ, 8AQF, 8ARI, 8AUO, 8AAV, 8AWP, 8AWY, 8BBK, 8BDO, 8BDU, 8BRL, 8BUM, 8BXH, 8BZJ, 8CLD, 9AJA, 9AKR, 9AZE, 9BRL, 9IO, 9KP.

1BGI, Bangor, Me.

C.W.: 1AC, 1AK, 1CP, 1CY, 1DF, 1FB, 1II, 1LP, 1PT, 1QN, 1QP, 1QR, 1RD, 1RV, 1TS, 1UN, 1WV, 1XF, 1XK, 1XM, 1XX, 1YB, 1YK, 1YN, 1ZE, 1AFP, 1AFU, 1AIG, 1AJP, 1AMQ, 1ANQ, 1ARY, 1AVR, 1AWL, 1AXI, 1AYL, 1AYR, 1AZW, 1BAS, 1BDC, 1BDI, 1BEA, 1BEC, 1BEA, 1BEP, 1BES, 1BIF, 1BIR, 1BIS, 1BKE, 1BKQ, 1BLA, 1BLE, 1BMY, 1BQE, 1BQI, 1BRP, 1BSD, 1BUA, 1BWJ, 1CAK, 1CGS, 1CIV, 1CLI, 1CLN, 1CLZ, 1CNF, 1CJH, 1CUH, 1DEA, 1XAD, 2BA, 2BB, 2BG, 2CC, 2CS, 2DH, 2DK, 2EH, 2FD, 2FF, 2HI, 2KL, 2KU, 2NN, 2NZ, 2OM, 2RB, 2RM, 2RP, 2UD, 2VA, 2VH, 2WP, 2XQ, 2AAB, 2AAJ, 2AGB, 2AJF, 2AJR, 2AJW, 2ALR, 2ANQ, 2AVU, 2AWF, 2AWK, 2AWL, 2AYV, 2BAK, 2BAS, 2BAY, 2BBB, 2BCF, 2BEA, 2BEB, 2BFZ, 2BGI, 2BGM, 2BIS, 2BNZ, 2BRB, 2BRC, 2BYW, 2CDA, 2AS, 2BF, 2BG, 2BS, 2BZ, 3CA, 3CC, 3CG, 3DH, 3DM, 3FS, 3GM, 3HX, 3Y, 3KM, 3LH, 3LR, 3MO, 3RF, 3RW, 3SQ, 3VW, 3WF, 3YK, 3ZC, 3ZO, 3ZY, 3ZV, 3ADT, 3AHK, 3AIS, 3AJB, 3AJD, 3AQH, 3AQR, 3ASV, 3BEC, 3BHL, 3BJ, 3BLF, 4BY, 4DC, 4GL, 5AN, 5FV, 5U, 5AW, 5BK, 5BS, 5BZ, 5DR, 5GQ, 5HJ, 5IQ, 5IV, 5JL, 5JQ, 5JS, 5KS, 5NI, 5OW, 5PU, 5QB, 5QM, 5SP, 5UJ, 5UK, 5VJ, 5XA, 5XV, 5ZG, 5ZV, 5ZZ, 5ABO, 5AGC, 5AGO, 5AGZ, 5AHR, 5ALY, 5AMK, 5AMQ, 5APH, 5APT, 5APW, 5AQF, 5AQO, 5AQV, 5ASG, 5AWP, 5AWY, 5AXC, 5AXO, 5AYZ, 5BHR, 5BDB, 5BFX, 5BGX, 5BIX, 5BNJ, 5BNS, 5BNY, 5BUM, 5BUZ, 5BXA, 5BXH, 5BXS, 5BZY, 5CAZ, 5CFP, 5CMZ, 5AL, 5DV, 5HR, 5HW, 5IO, 5AAY, 5ARK, 5AKD, 5BLO, 5DWJ, Can. 2BG.

Spark: 1AW, 1BH, 1CM, 1DZ, 1FV, 1GM, 1GQ, 1HK, 1OJ, 1OT, 1RV, 1TS, 1YB, 1YD, 1AEB, 1AFZ, 1AHL, 1AMD, 1APO, 1ARM, 1ARY, 1AZK, 1BCF, 1BDT, 1BIR, 1BIS, 1BOQ, 1BVB, 1CAK, 1CHJ, 1CIK, 1XAH, 2BK, 2BM, 2BY, 2DN, 2EL, 2FP, 2OM, 2XK, 2XQ, 2BJO, 3LC, 3OU, 3XM, 3ZA, 3ZV, 3AY, 3EA, 3JQ, 3MZ, 3SP, 3XE, 3ZY, 3ACF, 3AXO, 3BER, 3BEP, 3HR, 3KGE, Can. 3BP.

1BKQ, Worcester, Mass.

C.W.: (1FD), 1FF, 1LZ, 1MX, 1NE, (1ON), (1PT), 1RD, (1XM), 1ZE, 1AGI, (1ARY), 1AVI, 1AVR, 1AWB, 1AZW, 1BAL, 1BDI, 1BEA, (1BKR), (1BLE), 1BQE, 1BQK, 1BQL, 1BRQ, (1BSD), 1BUA, (1BWJ), 1BYG, 1CAC, 1CEC, 1CDZ, (1CGS), 1CIK, (1CLI), 1CMK, 1CNI, 1COA, (1COD), 2BB, 2BT, 2CG, 2DA, 2DN, 2ER, 2FP, 2KP, 2LD, 2NZ, 2PZ, 2RM, (2SQ), 2TP, 2TU, 2VA, (2VH), 2WI, 2AAB, 2AAG, 2AFP, 2AJF, 2AJW, 2AKO, 2AKV, 2ALR, 2AWF, 2AWL, 2AYV, 2AYZ, 2BAK, (2BBB), (2BCF), 2BEB, (2BEH), 2BEJ, 2BML, (2BNC), (2BNZ), 2BSC, 2BTJ, 2CBG, 2CCD, 3AW, (3BA), 3BG, 3BZ, 3CA, 3CM, 3EM, (3FM), (3FO), (3FR), 3FS, 3HF, 3HJ, (3IZ), 3JH, 3LR, 3RW, 3SH, (3UQ), 3WJ, 3XM, (3ZO), (3ZY), 3ZZ, 3AAD, (3AAE), 3ABT, 3ADT, 3ADX, 3AFB, 3AJF, (3ALN), (3ALU), 3AMG, 3ANO, 3ANX, 3APQ, 3AQH, (3AQR), 3ARN, 3BAG, 3BAR, 3BEC, 3BFU, 3BIY, 3BLF, 3BNU, 3XAA, 4BY, 4CO, 4DC, 4DY, 4FT, 4GC, 4GL, 4HW, 5DA, 5FV, 5U, 5ZA, 5AV, 5BB, 5BK, 5BT, 5DR, 5HJ, 5JJ, (5JL), 5JU, 5KS, 5LB, 5MP, (5NB), 5NI, (5PX), 5QB, 5QM, 5QY, 5RM, 5RO, 5SE, 5SP, 5TB, 5TN, (5UK), 5VL, 5VY, 5WE, 5WK, 5WY, (5XV), 5ZG, 5ZZ, 5AAY, 5ACF, 5ADG, 5AGO, 5AGZ, 5AIG, 5AIM, 5AIO, (5AJV), 5ALB, (5AMK), 5AOA, 5AOD, 5AOT, 5APN, 5APT, 5AQN, (5AQV), 5ARD, 5AWH, 5AWM, (5AWP), (5AXC), 5AXK, 5AXM, 5AXO, 5AXY, 5AYS, 5AYT, 5AYY, 5BAE, 5BBK, 5BBW, 5BDO, 5BDU, 5BIL, (5BNJ), 5BRC, (5BRL), 5BUM, 5BUQ, 5BXA, 5BXH, 5CAZ, 5CFP, 5CLD, 5ZAC, 5DV, 5FM, 5HW, 5IO, 5JI, 5KP, 5UH, 5WU, 5XI, 5AAV, 5ACY, 5AHK, 5AIV, 5AJA, 5AJH, 5AKR, (5ALS), 5ARK, 5AYH, 5BRL, 5DTJ, 5ZIF, 5ZAF, (5ZF).

Sparks: 1ADL, 1AKG, 1ARY, (1ASF), (1CHJ), 2CT, 3DN, 2ER, 2FP, 2JO, 2AQI, 2BJO, 3BG,

3FP, 3HJ, 3OU, (3TA), 3UD, 3ARM, 3AB, 3BO, 3FT, 3UC, 3WO, 3WU, 3XE, 3ABY, 3AGK, 3AIB, 3AIM, 3AKQ, 3APB, 3AWF, 3AWP, 3BDY, 3BSS, (3BXX), 3BP, 3AAW, 3DCX. Can. 3BP, 3EI, 3KG.

### 2AQU, Newark, N. J.

Spark: 1ADC, 1ADL, 1AHL, 1AKC, 1AKG, 1ARY, 1ASF, 1AW, 1AZK, 1BDT, 1BOQ, 1BQA, 1BRQ, 1BVH, 1BYG, 1OE, 1RV, 1WQ, 1ZE, 2AHU, 2DA, 2GK, 2XQ, 3AHK, 3AIC, 3AJD, 3ALN, 3AUW, 3BCQ, 3GX, 3HG, 3HJ, 3OU, 3QN, 3UC, 3XM, 4CP, 4CX, 4EA, 4GN, 5PY, 5XA, 5ABM, 5ACF, 5AFG, 5AHH, 5AJT, 5ALO, 5AMZ, 5ANO, 5APB, 5ARD, 5AUY, 5AWU, 5AXY, 5AYC, 5AYN, 5BAZ, 5BBO, 5BEP, 5BHV, 5BRL, 5BUN, 5EO, 5LB, 5NO, 5QC, 5SP, 5TT, 5UC, 5WD, 5WO, 5XE, 5YAE, 5YH, 5YN, 5YV, 5ZAA, 5ZAC, 5AAU, 5AGR, 5APH, 5APS, 5BP, 5DCX, 5DF, 5DIW, 5DLX, 5DWP, 5DZI, 5PB, 5UH, 5YAE, 5YB, 5YQ. Can. 3GN.

C.W.: 1AFV, 1AGI, 1AIP, 1AMQ, 1ARY, 1AVR, 1BDI, 1BEA, 1BKQ, (1BQE), 1BUA, 1BWJ, 1BYG, 1CAK, 1CGS, 1COD, 1MX, 1QN, 1QP, 1TS, (1XX), 1ZE, 2AAB, 2AWF, 2EH, 3AAD, 3AAG, 3AAO, 3AAY, 3ADT, 3AJD, 3AJD, (3ALE), 3ALN, 3ANJ, 3AQR, 3ARV, (3ASO), 3BEC, 3BG, 3BHL, 3BJL, 3BLF, 3BZ, 3CM, 3FS, 3HG, 3HJ, 3LC, 3NH, 3RM, 3SM, 3XAA, 3ZO, 3ZY, 4BK, 4BQ, 4CO, 4FT, 4GL, 4ID, 4IL, 4YA, 4ZE, 5NZ, 5UU, 5ZA, 6JD, 6PT, 8ABO, 8ABV, 8ACR, 8ADG, 8AGO, 8AGZ, 8AHZ, 8AIG, 8AIM, 8AJV, 8AMK, 8AOO, 8APT, 8AQF, 8ARD, 8ARI, 8AVD, 8AWF, 8AWP, 8AWY, 8BBK, 8BBD, 8BET, 8BFX, 8BFX, 8BK, 8BLT, 8BO, 8BOX, 8BRL, 8BUM, 8BUQ, 8BVK, 8BZH, 8CAB, 8CGX, 8CW, 8HJ, 8IL, 8NI, 8OC, 8PX, 8UK, 8VJ, 8VY, 8WA, 8WA, 8WR, 8XV, 8XX, 8ZAE, 8AAS, 8AAY, 8ACE, 8AJH, 8AMU, 8AS, 8AXF, 8BED, 8BEL, 8BSG, 8DTJ, 8DV, 8DYN, 8DYT, 8IO, 8KP, 8YJ, 8ZL.

### 2AVE, Jamaica, L. I.

C.W.: 1FF, 1NE, 1AGI, 1AOL, 1AZW, 1BDI, 1BES, 1BQE, 1DN, 2FF, (2GA), 2JJ, (2MM), 2RB, 2RM, (2RY), (2SQ), 2UJ, 2VA, 2XJ, 2ADT, 2AEQ, 2AJR, 2AMO, 2ANZ, 2AQU, 2AUU, 2AVV, 2AZZ, (2BCF), 2BW, 2BEH, 2BFZ, 2BIV, 2BJQ, 2BKE, 2BLF, (2MW), (2BNC), 2BNL, (2BQW), (2BTW), (2BUO), (2BWA), (2BWW), (2BYW), 2BZV, 2CAF, 2CAH, 2CCD, 2CDK, (2CDW), (2CEC), (2CKQ), 2CIR, 3BG, 3CG, 3CM, 3FS, 3VW, 3YM, 3ZO, 3ZY, 3AAD, 3AAG, 3APB, 3ALN, 3APZ, 3AQR, 3BAG, 3BLF, 3BLU, 3XAA, 3ZAB, 4AZ, 4CO, 4EH, 4EW, 4FT, 4GL, 4ZE, 5NZ, 5UU, 5ZA, 5BK, 5BO, 5JU, 5LB, 5LF, 5LW, 5NB, 5SP, 5UK, 5VJ, 5VY, 5XV, 5ZA, 5ZG, 5ZV, 5ABV, 5AGZ, 5AIM, 5AIO, 5AOA, 5AQF, 5AQV, 5AVD, 5AWI, 5AYT, 5AWP, 5BBK, 5BRL, 5BUM, 5BVK, 5XAD, 5JR, 5KP, 5AAV, 5AJA, 5AJH, 5AXF, 5BLO, 5BRK, 5YAM. Can. 3CZ.

Spk: 1LZ, 1AGX, 1BQL, 1CHJ, 3AC, 3GE, 3GX, 3HJ, 3UD, 3AJD, 3ARM, 3ASH, 3AUW, 3BJT, 4EA, 4ET, 5HK, 5PY, 5EW, 5IH, 5IN, 5JJ, 5JL, 5LB, 5OD, 5SP, 5UC, 5WE, 5XE, 5WO, 5YH, 5ABM, 5ACF, 5AHH, 5AHS, 5ALO, 5AMZ, 5AOI, 5APB, 5AUY, 5AWY, 5AXC, 5AXY, 5AYN, 5BBO, 5BEN, 5BHU, 5BHV, 5BKC, 5BUM, 5BXC, 5BXX, 5AV, 5VL, 5ZJ, 5AAW, 5ACY, 5AFI, 5DIO, 5DKV. Can. 3GN, 3KG.

### 2ACW, Schenectady, N. Y.

Spark: 1ACO, 1ADL, 1AHF, 1ARY, 1AZK, 1BCF, 1BDI, 1BHR, 1BJE, (1BOQ), 1BQA, 1BRQ, 1BZ, 1CHJ, 1GM, 1LZ, 1OZ, 1RV, 1YB, 2AAF, 2ABM, 2AIM, 2ARK, 2BJO, 2BK, (2BM), 2BSC, 2DI, 2EL, 2NB, 2OM, 2PF, 2TS, 2WB, 2XK, 2AAB, 2AFS, 2AHK, 2AK, 2ARN, 2AUW, 2BFU, 2BGT, 2CC, 2FP, 2GX, 2HG, 2HJ, 2PB, 2PU, 2QW, 2UC, 2UD, (2UQ), 2ZX, 4EA, 4CX, 5AAA, 5AAR, 5ACF, 5ADQ, 5AFA, 5AFB, 5AFG, 5AGK, 5AHE, 5AHS, 5AJT, 5AKQ, 5ANW, 5AUY, 5AXC, 5AXO, 5AXQ, 5AYN, 5BEP, 5BDV, (5BFH), 5BHV, 5BMC, 5BOG, 5BVS, 5CEB, 5CF, 5CFX, 5CG, 5CH, 5EO, 5EW, 5FS, 5FT, 5IN, 5LB, 5MZ, 5NI, 5OP, 5PL, 5QC, 5QE, 5QQ, 5SP, 5UR, 5VQ, 5WD, 5WO, 5XE, 5YM, 5ZP, 5AAP, 5AAW, 5ACB, 5ACL, 5AOE, 5APB, 5AV, 5AVP, 5CA, 5DFK, 5DFX, 5DKV, 5HR, 5JN, 5RC, 5UU, 5YAC, 5YAE, 5YB, 5YQ. Can. 2CI, 3BA, 3BP, 3EH,

3EI, 3EO, (3FO), 3GE, 3GN, 3JL, 3KG.

C.W.: 1AJS, 1BEA, 1BGF, 1BKQ, (1BUA), 1BYK, 1CGO, 1CMD, 1CNF, 1PT, 1UJ, 1XX, 1XY, 2AAB, 2AJF, 2AJR, 2ANZ, 2BAY, 2BEA, 2BGI, 2BNZ, 2BRC, 2VA, 3ADT, 3ADK, 3AHH, 3AQE, 3BEC, 3BG, 3CG, 3FS, 3OQ, 3TJ, 3ZO, 3ZY, 4EW, 4GL, 4LP, 5BM, 5FV, 5UF, 5AVO, 5AWP, 5AWY, 5AWZ, 5BDO, 5CA, 5DR, 5XK, 5ZX, 5ZZ, 9AJA, 9ALS, 9ARK, 9DKH, 9DV, 9PS, 9MU, 9ZY.

### 2BII, East Orange, N. J.

Spark: 1ADC, 1ADL, 1AIL, 1AKQ, 1AMD, 1AMQ, 1APO, 1ARY, 1AYQ, 1BDT, 1BGF, 1BHO, 1BJE, 1BOQ, 1BQL, 1BRQ, 1BSZ, 1BTL, 1BVE, 1BVH, 1CK, 1CP, 1CZ, 1GM, 1HK, 1IN, 1LZ, 1MA, 1OJ, 1ON, 1RV, 1SN, 1SO, 1UL, 1WQ, 2DA, 2GK, 2PV, 2SZ, 3AJD, 3ARN, 3ARY, 3BHM, 3CG, 3GM, 3GX, 3JL, 3NB, 3TA, 3XM, 4AU, 4BG, 4DH, 4EA, 5DA, 5JU, 5ABM, 5ACD, 5ACF, 5AFA, 5AFG, 5AIO, 5AKO, 5AKQ, 5ALO, 5ANW, 5AOT, 5APB, 5ARD, 5AUV, 5AVO, 5AWP, 5AWU, 5AWX, 5AWY, 5AXC, 5AXO, 5AXQ, 5AXY, 5AY, 5AYN, 5BBO, 5BCO, 5BDY, 5BFM, 5BFV, 5BLO, 5BRL, 5BX, 5BXC, 5BXX, 5BZC, 5CP, 5CQ, 5DX, 5DY, 5EA, 5HR, 5IH, 5IN, 5JJ, 5JP, 5JQ, 5KY, 5LH, 5MT, 5SF, 5SP, 5UC, 5UP, 5VQ, 5WD, 5WE, 5XE, 5YU, 5YV, 5ZAY, 5ACB, 5ACY, 5AGR, 5AIU, 5AJH, 5AR, 5AYH, 5AZE, 5BP, 5BXP, 5DBQ, 5DCX, 5DIW, 5DK, 5DKH, 5DWP, 5DXM, 5OX, 5RC, 5UH, 5UM, 5UU, 5ZJ, 5ZK, 5ZL. Can. 3BP, 3GE.

C.W.: 1AGW, 1AQZ, 1ARY, 1AVI, 1AVR, 1AWB, 1AZW, 1BAI, 1BDI, 1BDG, 1BEA, 1BJH, 1BKQ, 1BQE, 1BUA, 1BWJ, 1BYG, 1CGO, 1CGS, 1CIK, 1CJH, 1COA, 1ES, 1FE, 1II, 1IV, 1PT, 1QE, 1QN, 1UJ, 1XM, 1XX, 1ZE, 2BY, 3AAG, 3AAN, 3ACQ, 3ADK, 3AFB, 3AHK, 3AIG, 3AJD, 3ALI, 3ALN, 3ANQ, 3AQR, 3ASO, 3BEC, 3BEK, 3BFQ, 3BHL, 3BHM, 3BJL, 3BLF, 3CG, 3CO, 3DH, 3FR, 3FS, 3HG, 3IZ, 3KM, 3NH, 3OU, 3RW, 3UH, 3ZAB, 3ZY, 4AZ, 4BY, 4CO, 4DK, 4EN, 4FF, 4GL, 5FT, 5FV, 5UU, 5ZA, 5ZAD, 5ALE, 5ZA, 5ZB, 5AJV, 5AKS, 5ALB, 5AMB, 5AMD, 5AML, 5AMM, 5ACF, 5ADG, 5AGF, 5AGZ, 5AIG, 5AIM, 5AIO, 5AMZ, 5AOG, 5AOO, 5ARI, 5ARK, 5ASG, 5ASK, 5AVD, 5AWP, 5AWZ, 5AXK, 5AXO, 5AXQ, 5AYT, 5AZF, 5BBD, 5BBK, 5BDB, 5BDO, 5BET, 5BFX, 5BK, 5BLD, 5BO, 5BOX, 5BRL, 5BTP, 5BUM, 5BUQ, 5CAZ, 5CFK, 5CGM, 5GS, 5GV, 5HJ, 5IV, 5JL, 5LB, 5LW, 5LX, 5MB, 5ME, 5NB, 5NV, 5OH, 5OS, 5SJ, 5SP, 5UJ, 5UK, 5VJ, 5ZY, 5WB, 5WL, 5WM, 5WO, 5WR, 5XK, 5XV, 5ZAE, 5AAS, 5AAU, 5AAL, 5AAY, 5AIG, 5AJA, 5AJH, 5AKD, 5AKR, 5ALS, 5AYS, 5BED, 5BRL, 5BSG, 5KP, 5SJ, 5ZAF. Can. 2BG, 3BP, 3GN, 3KE, 3KG.

### 2BND, Oceanport, New Jersey

1ADL, 1AEV, 1AGI, 1AOL, 1ARY, 1AZJ, 1BCV, 1BDC, 1BFX, 1BIL, 1BKA, 1BKQ, 1BOQ, 1BPZ, 1BQE, 1BWY, 1BYX, 1CAK, 1CAL, 1CDR, 1CLL, 1DWJ, 1DF, 1GM, (1IV), 1OE, 1OG, 1PM, 1RU, 1TJ, 1UN, 1UQ, 1ZE, 2ADL, (2AVU), 3AA, 3ADT, 3AHK, 3AIC, 3ANJ, 3AWK, 3BEC, 3BHL, 3BIY, (3BZ), 3CC, 3DH, 3FD, 3HG, 3XM, 3ZAB, Can. 3BP and 3FO, 4BY, 4CE, 5EA, 5EL, 4GL, 5ACF, 5AFD, 5AFV, 5AGZ, 5AHR, 5AJT, 5AMK, 5AMQ, 5AOF, 5AQZ, (5AQF), 5AWP, 5AXO, 5AYN, 5AYS, 5AYV, 5AZH, 5BCO, 5BEP, 5BFX, 5BNI, 5BOX, 5AP, 5BK, 5BO, 5BP, 5DE, 5DR, 5DY, 5EO, 5IL, 5IF, 5IQ, 5IV, 5JL, 5JQ, 5JS, 5OE, 5OI, 5QY, 5SP, 5RU, 5TT, 5WC, 5WE, 5WS, 5XE, 5XH, 5XS, 5XU, 5YH, 5YN, 5ZR, 5ZY, 5ZZ, 9AAV, 9AIV, 9AKR, 9AMB, 9DWP, 9EI, 9LQ, 9LR, 9WU, 9YQ, 9ZJ, 9ZN.

Spark: 1BOQ, 2KB, 2NB, 2OM, 3AAM, 3AC, 3AIC, 3AN, 3AJD, 3EJ, 3GZ, 3HG, 3IA, 3OU, 3QW, 3RA, 3SF, 3UC, 3VS, 3WF, 3YH, 4EA, 4GN, 5DA, 5PY, 5XA, 5AFD, 5AFG, 5AJT, 5ARD, 5ATU, 5AZC, 5BAZ, 5BEF, 5BEG, 5BEP, 5BHV, 5BIA, 5BRD, 5EH, 5OD, 5QE, 5SP, 5RQ, 5UC, 5UD, 5AAJ, 5AEK, 5AGR, 5AIR, 5AOE, 5ASJ, 5BP, 5CP, 5DSO, 5DWP, 5EP, 5FS, 5GI, 5UH, 5VL, 5WK.

C.W.: 1AYL, 1BGF, 1CGO, 1CLL, 1PT, 1TS, 1UN, 2AAB, 2AWA, 2AFP, 2BEH, 2BYW, 2IB, 2KP, 2OF, 3AAY, 3AHK, 3AJE, 3AJD, 3ALN, 3ANY, 3APT, 3AQR, 3BA, 3BAG, 3BG, 3BJA, 3BKS, 3BLF, 3BS, 3BZ, (3FQ), 3FS, 3GN, 3HG, 3IB, 3KM, 3MZ, 3RF, 3RM, (3SQ), 3VS,



8BK, 8AXK, 8AYZ, 8AGO, 9AJ, 9AKD, 9IO,  
9JL, 9BHI, 9BRK.  
9BLO, 9BRL, 9ANS, 9KP, 9AAY, 9AAS, 9AOU.  
Spark: 2ABB, 3APD, 3BG, (3AAL), 8AU, 8BR,  
8ARY, 8DN, 8YMC, 8BV, 8AKQ, 8WT, 8XE,  
8ADQ, 9ZN, 9GC, 9XM, 9DF, 9EC, 9BIW.

C.W.: 1FF, 1QN, 1UN, 1UJ, 1PT, 1ZE, 1AFV, 1AGI), 1AIP, 1AJS, 1ARY), 1AZW, 1BDI), 1BEA, 1BES, 1BTL, 1BUA, 1CAK, 1CIK, 1BWJ, 2DN, 2EH, 2FP, 2KP, 2LO, 2PZ, 2RB, 2SQ, 2VA, 2XA, 2XK, 2ZS, 2AAB, 2AFP, 2AQU, 2AYL, 2AKO, 2AJF, 2AYV, 2AJA, (2ANZ), 2BML, 2BEH, 2BLP, 2BGM, 2BEA, 2BFZ, 2BCF, 2BAK, 2BVS, 2BEB, 3AS, 3BA, 3BJ, (3CG), (3CA), 3CC, 3CM, (3FM), 3FS, 3HJ, (3HG), 3IZ, (3RF), 3SQ, 3TJ, (3ZO), 3AWF, 3AJD, 3AQR, (3AAG), 3AAY, 3AQH, 3AAD, (3AHK), 3BQY, 3BIO, 3BJL, 3BLF, 3BHL, 4AZ, 4AB, 4BY, 4BK, 4DC, 4EB, (4FT), (4GL), 4GX, 4ID, 4YA, (4ZE), 5FV, 5LA, (5UU), 6ZZ, (8BK), 8BA, 8BO, (8CW), 8DR, 8GS, 8GV, 8HJ, (8JL), 8JU, (8LX, 8LW, 8NI, 8OS, 8OC, 8OW, 8PX, 8QB, 8SF, 8UK, 8VY, 8VJ, 8WR, 8XK, 8XV, 8ZG, 8ZZ, 8AIO, (8AMM), (8AQV), 8AWP, 8AQF, 8AXK, 8AIG, 8AWY, 8AJW, 8AMD, (8AWZ), 8AXC, 8ASB, 8AGZ, 8AQO, 8AIM, (8ACF), 8AVH, 8AWM, 8ARW, 8AYZ, (8BUM), 8BQM, 8BCA, 8BXH, 8BRC, 8BOX, 8BFX, 8BNY, 8BDO, 8BUX, 8BNJ, 8CAZ, 8CLD, 8CGT, 8CHO, 8YAA, 8QM, 9AS, 9AG, 9DV, 9IO, 9LE, 9NX, 9HW, 9SJ, 9WO, 9XM, (9ZL), 9ZY, 9AWM, (9AAV), 9AJF, (9AJH), (9AJA), 9ALS, 9AKD, 9AAY, 9BBL, 9DYN, 9XAQ, AN6, DF1, KDKA phone, WBL phone, NZO, (WUBC).

Spark: 1AKG, 1ARY, 1BHR, 1CHJ, 2BK, 2FP, 2OM, 3AHK, 3CAA, 3BP, Can. 8EB, 8IN, 8RQ, 8UC, 8WO, (8XE), 8ACF, 8ARD, 8AXC, 8AXY, 8BBO, 8BBU, 9BP, 9CA, 9UU, 9AAW, 9AGR, 9DKV.

1BCG. 1AW. 1AAW. 2QR. 2ALY. 3AM. 3EL.  
4EL. 4BY. 4ZO. 4AF. 4AQ. 4LT. 4GH. 4DS. 4GL.  
4AS. 4GM. 5AR. 5SA. 5LP. 5AW. 5CA. 5FQ. 6AE.  
6EL. 6FA. 6BK. 6NR. 6YN. 6MR. 6AE. 7DA. 7AS.  
7PQ. 7ES. 7GA. 7HE. 7GE. 7ER. 8CX. 8BCL.  
8BUN. 8BK. 8HA. 8ALY. 8AM. 8PE. 8CA. 9XM.  
9PL. 9AR. 9ZN. 9PL. 9ZL. 9CR. 9CS.

Spark: 3AOV, 4AS, 4BQ, 4BC, 4CP, 4CX, 4DZ,  
4EH, 4GU, 5AA, 5DA, 5FO, 5GI, 5HK, 5TG, 5XA,  
5YL, 5ZAB, 8ABV, 8AEK, 8AFG, 8AYN, 8BEP,  
8CP, 8DJ, 8EB, 8UC, 8XE, 8YM, 9ACB, 9AEK,  
9AOJ, 9AQM, 9DGX, 9DFX, 9DLX, 9DQQ, 9DHZ,  
9MC, 9PE, 9YC.

C.W.: ITS, IUN, 2AAB, 2AAG, 2AGB, 2ZG,  
2ZL, 3BHI, 3BIJ, 3BLF, 3BZ, 3LR, 3RF, 4BK,  
4BQ, 4CO, 4AZ, 4EM, 4EU, 4EW, 4GU, 4HW,  
4HO, 4ID, 4XD, 4ZE, 5AAM, 5DA, 5EK, 5FV,  
5JB, 5KU, 5LA, 5NZ, 5UU, 5ABV, 5AOA, 5AKR,  
6AWZ, 6BFX, 6BOX, 6CAZ, 6CQU, 6GV, 6JL,  
6UJ, 6XK, 6BLO, 6BRL, 6DTW, 6DWP, 6DYN,  
810, 9NX.

## 4YA, Atlanta, Ga.

2AAB, 2ALR, 2CBG, 2AKO, 2PF, 2BEG, 2OM, 2ZO, 3FS, (3ZY), 3BLF, 3CM, (3XM), 3BIY, 3ZC, 3BZ, 4EW, 4AG, 4BY, 4EU, (4AS), (4EB), (4BK), (4BQ, 4ZE, 4DZ, 4EA, 4GU, 5AA, 5HK, 5XA), 5ZL, (5NZ), 5ZAB, 5ZX, 5EK, (5XB), 5ZAP, 5ZZ, 5KP, 5PY, 5GI, 5EY, 5RA, 5LA, 5AJ, (5UU), 5YM, 5YL, (5FV), 5KU, 5FJ, 7VY, (8AIM), 8YU, 8AWP, 8VY, 8BOX, 8AJV, 8UC, 8BRK, 8BFX, (8AYM), 8AVH, 8AQF, 8AFG, 8AMD, 8BGU, 8AGZ, 8ACF, 8DJ, 8BEP, 8AUE, 8BEX, 8ZY, 8FS, 8ASB, 9JU, 8WD, 8BK, 8XK, 8XF, 8ZW, 8SP, 8VX, 8AFC, 8DHG, 8YAE, 8XE, 9HK, 9YC, 9BVL, 9YE, 9BJV, 9IO, (9DUN), (9BED), (9AS), 9AFW, 9AQ, 9DEJ, 9ZAC, 9EA, 9ACK, 9ARI, (9AJH), 9WU, 9EI, (9AJA), 9XI, 9LF, 9DTS, 9BBE, 9DKM, 9PS, 9PL, 9YMM, 9VQ, 9ASP, 9CAK, 9APA, 9AKR, 9JL, 9BO, 9DQ, 9TV, 9ALO, 9AUA, 9DIW, (9AIQ), 9EM, 9XM, 9FT, 9ZW, 9XJ, 9DCF, 9YA, 9ARK, 9KS, 9YAK, 9AMQ, 9BAW, 9DSD, 9WT, 9ZJ.

## 4GM, Atlanta, Ga.

Spark: 2EH, 2FF, 2OM, 3AFD, 3AFU, 3AOV, 3EC, 3UC, 3YV, 4AS, 4BE, 4BQ, 4CX, 4DH, 4DK, 4EG, 4EZ, (4FD), 4GH, (4GN), 4GU, 5AA, 5BY, 5DA, 5EA, 5ER, 5EW, 5FO, 5GI, 5HK, 5IM, 5JD, 5JO, 5KU, 5NK, 5PE, 5PY, 5SM, 5SO, 5TG, 5XA, 5YG, 5ZZ, 5ZAB, 8AY, 8AGV, 8AJZ, 8ANO, 8ANW, 8ARD, 8AXC, 8AYB, 8AYN, 8AZP, 8BAZ, 8BFX, 8BHV, 8CP, 8SP, 8UC, 8VH, 8VQ, 8VY, 9AOJ, 9ARK, 9AZE, 9BLO, 9DCX, 9DFX, 9DHZ, 9YV, 9AU, 9AAW, 9ACB, 9AGE, 9AGR, 9AMS, (9DKV), 9DQK, 9DMJ, 9DNI, 9DXE, 9DYU, 9DZY, 9KO, 9LF, 9MC, (9OX), 9PG, 9RC, (9RY), 9UH, 9UU, 9VQ, 9VZ, 9ZB.

C.W.: 2FF, 3AIN, 3BIJ, 4BQ, 4BY, 4FD, 4ZE, 5FV, 5KU, 5XA, 8BK, 8AWP, 9AJA, 9ALS, 9CFP, 9GY, 9IO, 9NX, 9YM.

## 5IF, Amarillo, Texas

5AA, (5AE), (5BI), (5BM), (5BY), (5EK), 5ER, (5FA), (5FO), 5HI, (5HK), (5HZ), (5IB), (5IQ), (5IR), (5IS), (5JD), 5JI, 5JL, 5JR, 5JX, (5KP), 5LB, 5LO, 5LX, (5MJ), 5MM, 5MP, (5MY), (5NC), 5NH, (5NK), 5NR, (5NS), (5OF), 5OH, 5PD, (5PE), 5PG, 5PX, (5QA), (5QI), 5QQ, (5QS), 5QY, (5RA), 5SM, 5TG, 5XA, (5XB), (5XJ), (5XT), (5XU), 5YI, 5YN, 5YQ, (5ZA), 5ZD, 5ZJ, (5ZL), 5ZN, 5ZS, (5ZU), (5ZX), 5ZAA, 5ZAB, 5ZAC, 5ZAE, (5ZAF), 5ZAG, (5ZAK), 4BQ, (6TV), (6ZZ), (6AAH), 7MO, 7ZU, 7ZV, (9PS), 9RT, (9RY), (9TI), (9TL), (9UG), 9UU, (9HT), 9UN, 9KO, 9LF, 9MS, (9NR), (9OA), 8YU, (9AU), 9EL, 9ET, 9GN, (9HI), 9HM, 9VE, (9WI), (9WU), 9XJ, 9YA, 9YM, 9YO, 9ZJ, 9ZN, 9ZY, 9YAE, 9YAJ, 9YAK, (9ZAC), 9ZAF, 9AAS, (9ABV), 9ACB, 9ACN, (9AEG), 9AEB, 9AFC, 9AFL, 9AFW, 9AHZ, 9AIF, 9AIG, 9AJH, 9AJT, 9AKR, 9ALS, (9AMA), 9AMB, (9AMD), (9AMS), (9ANF), (9ANO), 9AOE, (9AQE), 9AQM, 9AQR, 9ARG, 9ARI, 9ARJ, 9ASJ, 9ASL, 9ASO, 9ATN, 9ATV, (9AUL), (9AUO), 9AVC, 9AVE, 9AVG, (9AWX), (9AYV), (9AYW), 9BAP, 9BBF, 9BOW, 9DEH, 9DEY, 9DFL, 9DJB, 9DJX, 9DKQ, 9DKV, (9DPB), 9DPE, 9DPH, (9DSD), (9DUG), 9DVA, 9DWP, 9DXX, (9DZE), 9DZR.

## 5AQ, Miami, Okla.

Spark: 5AA, (5BY), 5EK, 5ES, 5EW, 5FO, (5HJ), 5HZ, 5IF, 5IQ, 5IR, 5JD, 5KC, 5LA, 5LB, (5LO), (5NH), 5NK, 5QA, 5QQ, 5TG, 5UH, (5WI), 5XA, 5XB, 5XU, 5XL, 5ZA, 5ZL, 5ZZ, 5ZAB, 5ZAK, 7ZO, 8IG, 8MC, 8JC, 8VY, 8BC, 9BP, 9DW, 9EE, 9FK, 9HT, 9UN, 9KO, 9LW, 9MC, 9MS, 9PE, 9RC, 9UH, (9UU), 9WT, 9WU, 9WX, 9YM, 9YO, 9ZA, 9ZN, (9ZX), 9AAF, 9ABV, (9ADR), 9AEG, 9AEB, 9AFX, 9AGN, 9AGR, 9AIF, 9AKD, 9AKR, 9AMU, 9AOE, 9AOU, 9APS, (9AFX), 9AQM, (9ATN), 9AUL, 9AVI, 9AVX, 9AWA, 9AYA, 9AYV, 9BEK, 9BJB, (9DKV), (9DNI), 9DNS, (9DPB), 9DQK, 9DSD, 9DUG, (9DXX), 9YAC, 9YAE, 9YAK.

C.W.: 1BCG, 2FF, 4FI, 4GL, 4II, 4YA, 4YG, 4KM, 5EK, 5FV, (5JB), 5LA, 5ZA, 5ZAK, 8AQ, 8BK, 8VY, 8XV, 8BOX, 9BS, 9FM, 9KM, 9NX, 9PS, 9WS, 9XI, 9AGR, 9AJA, 9AQR, 9AYS, 9BDV, 9BED, 9BLO, 9BSG, (9DHB), 9DTS, 9DUN, 9DUP, 9DYN, 9YAM, 9ZAF.

## 5LA, New Orleans, La.

C.W.: (3ZY), 3HG, 3AKR, 3AQR, 3BLF, 4AS, (4BK), 4BQ, 4BY, 4CO, 4EB, 4EW, 4EH, 4EL, 4FH, 4FT, (4GL), 4GU, (4II), 4ID, 4XD, 4XF, 4ZE, 5ER, (5FV), 5EK, 5IR, 5KP, (5MT), (5ZA), 5XJ, 5UU, (5NZ), 5ZX, 5KU, 5ZU, 5ZAK, 5BK, 5BO, 5CG, 5CW, 5GV, 5IV, 5SI, 5SP, 5VY, (5WY), 8XK, 8XV, 8ZL, 8ZV, 8ARW, (8AGZ), 8AGO, 8AWZ, 8AQH, 8AWA, 8AQF, 8AXC, 8AAP, 8AIO, 8AIM, 8ABV, 8AKJ, 8AQR, 8BQJ, 8BOX, 8BFX, 8BVR, (8BEX), (8BXH), (8BZC), 8BRL, 9AT, 9BV, 9DY, 9EL, 9FM, 9HK, 9II, 9IZ, 9JL, 9JR, 9NX, 9PG, 9LY, 9SJ, 9WU, 9XI, 9ZL, 9ZW, 9AII, 9AUA, 9AAY, 9AWM, 9AJH, 9AAS, 9ALH, 9AMB, 9AYS, 9AKD, 9APH, 9AIE, 9AVN, 9AJA, 9AEQ, 9ALU, 9AMU, 9AIG, 9BBF, 9BED, 9BIG, 9BOW, 9BIK, 9BJB, 9SG, 9DIG, 9DKP, 9DKI, (9DZQ), 9DTM, 9DFL, 9DCF, 9DPE, 9DTW, 9DHB, 9YB.

## 5MB, Chattanooga, Tenn.

C.W.: 2BAY, 2LO, 2AWF, 3AEV, 3AQR, 3BIY, 3CA, 3HG, 3RF, 3ZY, 4AS, 4BD, 4BK, 4BY, 4EB, 4EH, 4ER, 4EL, 4CY, 4GL, 4II, 4YA, 5AN, 5BX, 5FV, 5FX, 5JD, 5JI, 5KU, 5LA, 5SU, 5WS, 5ZA, 5ZAB, 5ZW, 5ACS, 5ACV, 5AFG, 5AQV, 5AWP, 5AWZ, 5BDB, 5BJV, 5BLF, 5BK, 5BOX, 5BIQ, 5JU, 5WA, 5WI, 5YT, 5ZAC, 5AAS, 5AAV, 5AIK, 5AJH, 5AJP, 5AK, 5AKO, 5ARK, 5AUA, 5AVN, 5BED, 5BIZ, 5BLD, 5DPE, 9FM, 9PG, 9SJ, 9ZB.

Spark: 2AHU, 2BK, 3AOV, 3DV, 3HG, 4AG, 4AH, 4AU, 4BI, 4CP, 4DH, 4EA, 4EV, 4GH, 4GL, 4GN, 4GU, 4HS, 4JS, 4NB, 4BQ, 5AAG, 5DA, 5ER, 5EW, 5FO, 5GU, 5HK, 5HJ, 5IF, 5JD, 5PY, 5XA, 5XB, 5XH, 5XU, 5XY, 5YL, 5ZAP, 5ZL, 5AFD, 5AIZ, 5AP, 5AWY, 5BEP, 5BHO, 5BRL, 5CGZ, 5CFQ, 5JJ, 5SP, 5UC, 5US, 5WD, 5XE, 5YN, 5ABC, 5ACL, 5AEG, 5AGR, 5AIF, 5AIR, 5AIV, 5ATN, 5AWQ, 5AW, 5DCX, 5DI, 5DS, 5DXM, 5FN, 5GX, 5JN, 5LF, 5MC, 5QR, 5UH, 5VA, 5VE, 5VH.

## 5ZZ, New Orleans, La.

1ARY, 1BCG, 2EL, 2FP, 2NZ, 2AJF, 2ZL, 2AWL, 3AL, 3BL, 3BP, 3BZ, 3CA, 3MO, 3NZ, 3AHK, 3AJD, 3BHL, 3BLF, 4AE, 4AN, 4AS, 4AT, 4AU, 4BI, 4BK, (4BQ), 4BY, (4CG), 4CN, 4CP, (4DH), (4EH), 5EI, (4EL), 4FB, 4FD, 4FF, 4FT, (4GL), 4GN, (4GU), 4HW, (4YA), (4ZC), 4ZE, (5AE), 5BM, 5BY, 5DA, 5EK, 5ER, 5EW, (5FA), (5FO), 5FV, 5GI, 5GV, (5HK), 5HZ, 5IC, 5ID, 5IF, 5IR, 5IS, (5JD), 5JI, 5KP, 5KV, 5KU, 5LB, 5LO, 5LX, 5MA, 5MP, 5MY, 5MT, (5NB), 5NC, 5NF, (5NH), (5NK), 5NQ, 5NS, 5NZ, 5OF, 5OH, 5PD, 5PE, (5QA), 5QQ, 5QS, 5QZ, 5QY, 5QX, 5RA, 5TG, 5UC, 5UE, 5UJ, 5UU, (5XA), 5XB, 5XI, 5XJ, 5XK, 5XR, 5XT, 5XU, 5YB, (5YI), 5YN, 5ZA, 5ZC, 5ZD, 5ZI, (5ZL), 5ZO, 5ZR, 5ZS, 5ZT, (5ZU), 5ZW, 5ZX, 5AAM, 5ZAA, 5ZAF, 5ZAG, 5ZAK, 5ZAM, 5ZAN, 5BK, 5BO, 5BU, 5CP, 5CW, 5DE, 5DR, 5EA, 5FI, 5FG, 5HA, 5HJ, 5II, 5IQ, 5JL, 5JM, 5JP, 5JQ, 5LQ, 5LK, 5NZ, (5OI), 5ON, 5RB, (5SP), 5TN, (5UC), 5UJ, 5UK, 5VJ, 5VR, 5VY, 5XE, 5XK, 5XV, 5YM, 5YN, 5YR, 5YT, 5ZG, 5ZN, 5ZR, 5ZW, 8ZY, 8APB, 8ACF, 8ACL, 8ADE, 8AFB, 8AFD, 8AFG, 8AFW, 8AFS, 8AGK, 8AJK, 8AJT, 8AKS, 8AMB, 8ANO, 8ARD, 8ARG, 8AUH, 8AQF, 8AQV, 8AWZ, 8AYN, 8BEN, 8BEP, 8BFH, 8BHV, 8BIB, 8BOS, 8BOX, 8BFL, 8BRL, 8BUM, 8BGK, 8ZAA, (8ZAC), 9AU, 9BP, 9DV, 9DW, 9EL, 9ET, (9FS), 9FU, 9FZ, (9GC), 9GN, 9GX, 9HD, 9HI, 9HJ, 9HM, 9HR, 9HS, 9HT, 9IO, 9IY, 9JN, 9JQ, 9KC, (9LF), 9LW, 9LQ, 9MO, 9ME, 9MN, 9NH, 9NQ, 9NR, 9NX, (9OA), 9OB, 9OX, 9PD, 9PS, 9QE, 9QH, 9RV, 9RY, 9TL, 9TV, 9UV, 9UG, 9UH, 9UU, 9VG, 9VL, 9VV, 9WC, 9WI, 9WP, 9WU, 9XT, 9XJ, 9XM, 9YA, 9YB, 9YC, 9YM, 9YO, 9YQ, 9YT, 9YAE, 9YAK, 9ZB, 9ZJ, 9ZAC, 9AAK, 9AAF, 9AAS, 9AAV, 9AAI, 9ACB, (9ACL), 9ACN, 9AEG, 9AEK, 9AEY, 9AFF, 9AFL, 9AFX, 9AGH, (9ATF), 9AIO, 9AIP, 9AIR, 9AIV, 9AJE, 9ALS, 9AMA, 9AMB, 9AME, 9AMQ, 9AMS, 9AMT, 9AMV, 9ANF, 9ANO, 9AOJ, 9APB, 9API, 9AQA, 9AQE, 9AOJ, (9AQM), 9AQK, 9ARK, 9ARZ, 9ASJ, 9ASL, 9ATI, (9ATN), 9AVN, 9AVP, 9AWN, 9AWX, 9AWU, (9AWZ), 9AXU, 9AYW, (9AZA), 9AZE, 9BBF, 9BCX, 9BDS, 9BED, 9BLO, 9DAZ, 9DCX, 9DKQ, 9DKV, 9DHP, 9DMJ, 9DQL, (9DQK), (9DUG), 9DRA, (9DSD), 9DTN, 9DWP, 9DWJ, 9DXM, 9DYU, 9DZJ, 9DZK, 9DZY.

**6AOW, Riverside, Calif.**

Spk.: 51P, 50P, 5XU, 5YQ, 5ZA, 5ZJ, 6AH, 6AS, 6OH, 6OL, 6OM, 6PJ, 6PO, 6PR, 6QR, 6RS, 6SJ, 6TF, 6TO, 6TU, 6TV, 6UW, 6VK, 6VX, 6VZ, 6WZ, 6XH, 6ZF, 6ZK, 6ZR, 6ZU, 6ZX, 6ZZ, 6AAF, 6AAH, 6AAU, 6ABM, 6ABP, 6ABX, 6ACV, 6ADI, 6AEH, 6AEI, 6AFN, 6AFP, 6AGF, 6AGP, 6AHA, 6AHD, 6AHP, 6AHQ, 6AHU, 6AHV, 6AHX, 6AHZ, 6AIB, 6AIF, 6AIN, 6AIT, 6AIU, 6AJT, 6AKL, 6AKR, 6ALD, 6ALP, 6ALU, 6ALV, 6AMI, 6AMK, 6AMN, 6ANG, 6AOE, 6AOR, 6ARK, 6ASA, 6ASV, 6ATH, 6ATF, 6ATQ, 6ATU, 6AUU, 6AVL, 6AVR, 6AWB, 6AWH, 6AWX, 6ZAE, 6ZAL, 6ZAM, 6BAJ, 6BCB, 6BCJ, 6BDZ, 6BFE, 6BGH, 6BIP, 6BIU, 7CK, 7DP, 7HF, 7HY, 7JW, 7JD, 7LN, 7LY, 7MF, 7MP, 7TY, 7YA, 7YJ, 7YG, 7ZE, 7ZJ, 7ZM, 7ZT, 7ZU, 7ZV.

C.W.: 4UL, 5ZA, 5XU, 6AK, 6EB, 6EN, 6GD, 6GY, 6IV, 6JD, 6JJ, 6KA, 6KY, 6MY, 6PJ, 6VM, 6ZA, 6ZB, 6ZR, 6ZT, 6ZZ, 6AAG, 6AAT, 6AIF, 6AKW, 6ALU, 6AOZ, 6ATG, 6AWP, 6AWT, 6XAD, 6XAF, 6XQA, 6XAF, 6BGG, 6BIF, 6BHG, 7XB, 9WH, 9WD, 9ZY, 9AMB, 9BJL, 9DTM, 9DVA, 9ZAF.

**6AJU, Farmington, Calif.**

Spk.: 5ZA, 6ACR, 6ADA, 6AEH, 6AEW, 6AIX, 6ALD, 6ALU, 6ATF, 6ATQ, 6BAZ, 6EB, 6EN, 6GT, 6IS, 6IV, 6JW, 6KS, 6LC, 6MH, 6OD, 6OL, 6OT, 6QR, 6SJ, 6TV, 6UP, 6VZ, 6WI, 6ZAA, 6ZAL, 6ZR, 6ZZ, 7BA, 7BH, 7BJ, 7BR, 7CU, 7CW, 7FL, 7GD, 7HM, 7JD, 7KB, 7KS, 7LO, 7MF, 7MP, 7NW, 7OT, 7VO, 7YA, 7YJ, 7YL, 7ZM, 7ZN, 7ZO, 7ZS, 7ZT, 7ZU, 9AX, 9XQA, Can. 9BD.

C.W.: 5ZA, 6ALE, 6ALU, 6ASV, 6AY, 6DA, 6GD, 6VM, 6WV, 6KH, 6ZA, 6ZAF, 7NX, 7QT, 7XF, 7YJ, 7ZS, 8AQZ, 8UK, 9AOS, 9AMB, 9AYU, 9BEX, 9BJL, 9DTM, 9NX, 9WD, 9XQA, 9ZAF.

**Radio 6ZE ex 6ALE, Readley, Calif.**

2FP, 4BY, 5IU, (5XJ), 5YQ, (5ZA), (6EB), (6EN), (6EP), (6EQ), (6GT), (6IV), (6JD), (6LC), (6MH), (6PO), (6QR), (6TU), (6VX), (6ZB), (6ZK), (6ZX), (6AAG), 6AAT, (6AAU), (6ABW), (6ACK), (6AFN), (6AHF), (6AIF), (6ALU), (6ALV), (6AMN), 6ZAM, (6BAJ), (6BFE), (6BDK), (6BGH), 6XQA, (7BA), (7BK), 7CK, 7CS, (7NW), (7NX), (7LY), (7MF), (7MP), 7NN, 7OM, (7QT), 7TJ, 7YA, 7YJ, (7ZM), 7ZO, 7ZT, 7ZV, 7XB, 7ZU, 8JL, 8VJ, 8AGZ, 8BRL, 9NX, 9WD, 9AJA, 9AMB, 9AYS, (9AYU), 9BEX, 9BJL, 9DTM, (9DVA), 9XQA, (9BD, Can.)

**6RR, Los Angeles, Cal.**

Spark: 5ZA, 5YQ, 5XU, 5ZJ, 6AK, 6QR, 6NM, 6OT, 6SJ, 6TV, 6PJ, 6UO, 6WV, 6XH, 6ZK, 6ZU, 6ZZ, 6ZX, 6AEH, 6AOF, 6AIN, 6AMK, 6AWH, 7JD, 7MF, 7YA, 7YG, 7XJ, 7ZM, 7ZT, 7ZU, 7ZZ, 9YAL, 9ZZ, CLS.

C.W.: 5ZAK, 6EC, 6GD, 6KU, 6PJ, 6PT, 6NM, 6NK, 6CM, 6ZA, 6ZB, 6ZZ, 6ZE, 6AAT, 6AAG, 6AIF, 6ALE, 6AVJ, 6AZX, 6ASV, 6AWP, 6ZAF, 6ZAK, 6ZAM, 6XAD, 6XAF, 7CS, 7OG, 7TQ, 8VJ, 8JL, 8XV, 8ZY, 8AGZ, 8BOX, 9AX, 9BD, 9JD, 9NX, 9JL, 9HA, 9HW, 9FS, 9WD, 9WU, 9PM, 9XU, 9ZL, 9ZV, 9AIG, 9AJA, 9AKS, 9AMB, 9AYU, 9BEX, 9BJL, 9DTH, 9DTM, 9DVA, 9XQA, 9ZAF, 9ZAC, Can. 9BD, 4CB.

**F. H. Stephens, Dilly, Ore.**

Spark: Can. 5AK, 6ABX, 6AGF, 6AHP, 6AIX, 6ALD, 6ALV, 6ALX, 6AMN, 6ARK, 6AS, 6ATQ, 6AAU, 6AZM, 6BIP, 6EX, 6FF, 6FH, 6FK, 6GR, 6GT, 6KM, 6OH, 6OL, 6PO, 6PR, 6ST, 6TO, 6TU, 6VK, 6VX, 6WZ, 6XH, 6ZAE, 6ZAM, 6ZK, 6ZR, 6ZX, 7AAV, 7BA, 7BG, 7BH, 7BK, 7BZ, 7CC, 7CD, 7CK, 7CN, 7DD, 7EO, 7FJ, 7GE, 7HF, 7HM, 7KE, 7KG, 7KJ, 7LY, 7MF, 7MP, 7NN, 7NW, 7NZ, 7OM, 7PC, 7PT, 7SC, 7TJ, 7TO, 7VO, 7VX, 7VZ, 7WG, 7WM, 7WT, 7XB, 7YA, 7YJ, 7YL, 7ZM, 7ZU, 7ZV, 9AVZ, Can. 9BD, 9ZX.

C.W.: Can. 4CB, 5YA, 6AIF, 6ALU, 6DY, 6EN, 6IG, 6JD, 6JJ, 6KA, 6NX, 6PE, 6RR, 6VM, 6XAF, 6XQA, 6XH, 6ZA, 6ZE, 6ZF, 6ZG, 6ZJ, 7EX, 7HS, 7HT, 7NF, 7PV, 7RN, 7XO, 8JL, 9AJA, 9ALS, 9DVA, 9WB, 9XM.

**7SN, Seaside, Ore.**

Spark: 6AK, 6AS, 6BB, 6BM, 6BK, 6CV, 6EX, 6FH, 6GG, 6HC, 6KC, 6KR, 6KM, 6LC, 6LU, 6OH, 6SU, 6TU, 6UO, 6VK, 6VX, 6ZK, 6ZX, 6AAU,

6ABH, 6ABM, 6ABW, 6ABR, 6AGF, 6AIX, 6AFN, 6ARK, 6AID, 6ARC, 6ALV, 6AVG, 6AVB, 6ALA, 7YS, 7YA, 7ZM, 7MF, 7NN, 7ZJ, 7YJ, 7BH, 7OY, 7TJ, 7VO, 7YM, 7BJ, 7HF, 7MU, 7WM, 7IW, 7CK, 7CN, 7ZT, 7YV, 7ZU, 7MP, 7BC.

C.W.: 6WZ, 6NR, 6EN, 6GD, 6XAD, 6ALE, 6AAT, 6AIF, 6ABX, 6AAG, 6AOZ, 6AFN, 6AWT, 7RN, 7TQ, 7XF.

Can. 9AX, 9BD, spar.: 4CB, C.W.

**7HD, Seaside, Ore.**

7BH, 7CN, 7FL, 7GE, 7HF, 7IW, (7KS), 7LY, 7MP, 7NZ, 7OY, 7RN-C.W., 7VO, 6AAU, 6AHA, 6ARK, 6AR, 6ZY, C.W.-6AIX, 6FH, 6VM.

**7PO, Seattle, Wash.**

Spark: 6AH, 6AK, 6BC, 6EB, 6EX, 6FH, 6GX, 6HF, 6IV, 6KM, 6LC, 6NL, 6OH, 6PO, 6PR, 6QB, 6TU, 6VX, 6XH, 6ZX, 6AAV, 6AAL, 6ABW, 6ABX, 6AFN, 6AGF, 6AHR, 6AIF, 6AIW, 6ZAA, 6ZAM, 7JW, 7KE, (7KG), (7KJ), 7KM, 7KS, (7LA), 7CN, 7FL, 7GJ, 7HF, 7IN, 7IW, (7IY), 7JT, 7AS, 7AW, (7BA), (7BC), (7BG), 7BH, 7BJ, 7LW, 7MF, 7MU, 7MY, 7NL, 7NN, (7TJ), 7VX, 7VO, 7VZ, (7WM), 7YA, 7YJ, 7ZP, 7ZT, 7ZU; Canadians: 5BI, 5FE, 5MK, 9AX, 9BD.

C.W.: 6AIF, 6ALE, 6AWT, (7CE), (7QE); Canadians: 4CB and 9BD.

**8CBJ, Lockport, N. Y.**

Spark: 1CK, 1KO, 1OE, 1RV, 1WQ, 1APO, 1ARY, 1BDT, 1BOQ, 1CHJ, 2BK, 2BM, 2DA, 2DN, 2EL, 2OM, 2TJ, 2TS, 2WV, 2AER, 2AID, 2ARK, 2AWP, 2CIC, 2AC, 2DM, 2FB, 2HJ, 3QW, 3UD, 3AGT, 3AIC, 3AUW, 3BFU, 4CM, 4EA, 4GN, 5DA, 5BQ, 5EB, 5FT, 5HG, 5IH, 5JJ, 5NZ, 5OD, 5UC, 5WD, 5WZ, 5ACF, 5AFG, 5AHU, 5AIO, 5AKQ, 5ANB, 5AOT, 5APE, 5ARS, 5AVD, 5AVT, 5AYN, 5BAZ, 5BEP, 5BFM, 5BHV, 5BUM, 5CAY, 5BP, 5CP, 5DI, 5FS, 5HW, 5IB, 5LZ, 5TL, 5UH, (5VL), 5YN, 5ACN, (5AGE), 5AIR, 5AKR, 5AMQ, 5APH, 5AQA, 5AQM, 5ARK, 5ASI, 5AVP, 5AWU, 5AZE, 5AZM, 5DBU, 5DKV, 5DLX, 5DSO, 5DVN, 5DWF.

C.W.: 1QP, 1RD, 1UJ, 1UN, 1XM, 1XX, 1ZE, 1AFV, 1AFZ, 1AOL, 1AZW, 1BCF, 1BDC, 1BDI, 1BEP, 1BKQ, 1BQE, 1BUA, 1BWJ, 1CHL, 1CTI, 2FP, 2VA, 2ZL, 2AFP, 2AWS, 2BBE, 2BJO, 2BNZ, 2BTJ, 2BZ, 2CA, 2CG, 2FS, 2HG, 2NH, 2ZO, 2AAY, 2AFB, 2AJD, 2ANJ, 2AQF, 2BAG, 2BHL, 2ZAB, 4BQ, 4DS, 4EW, 4GL, 4ID, 5DA, 5FV, 5BK, 5GV, 5HJ, 5JS, 5KS, (5NB), 5NI, 5OS, 5SP, 5TB, 5UK, 5VJ, 5ZX, 5ADG, 5AGZ, 5AJM, 5AMK, 5ANE, 5AQF, 5ASV, 5AWM, 5AWP, 5AWZ, 5BDO, 5BIZ, 5BNJ, 5BUM, 5BXH, 5BXX, 5BZY, 5CAZ, 5CER, 5CGM, 5IO, 5KP, 5AAS, 5AJP, 5AJW, 5AKD, 5BBF, 5BMN, 5BRL, 5DAX.

**8BET, Toledo, Ohio**

C.W.: 1AZW, 1BDI, 1BEA, 1BKO, 1ZE, 2FP, 2FT, 2WL, 2ZL, (3AAD), (3AAO), 3AFU, 3ALN, 3AQR, (3BA), 3BBB, 3BEC, 3BLF, 3CG, 3CM, 3HJ, 3LO, 3NZ, 3QV, 3SZ, 3ZY, 4BY, 4DC, 4FT, 4GL, 4HO, 4ID, 4KL, 4FL, 5FV, 5NZ, (5UU), 6JD, 5ADG, 5AGX, 5AGZ, 5AIG, 5AIM, (5AIO), 5AMD, 5AMM, (5AOG), 5AOZ, 5API, 5APW, 5AQV, 5ATV, 5AWP, 5AWZ, 5BDO, 5BEX, (5BK), 5BO, 5BOX, (5BOZ), (5BPE), 5BRL, 5BUM, 5BUN, (5BXA), 5BXH, 5BZC, (5CAB), 5CBZ, (5EA), (5GA), 8IV, 8IY, 8JJ, 8JL, 8JM, 8JW, 8KS, 8LX, 8NI, 8OW, 8PX, 8SP, (8UJ), 8UO, 8VJ, 8XAE, 9AAV, 9AEQ, 9AGB, (9AJA), 9AJH, 9AJP, 9ALS, 9AMU, 9ANZ, 9AOQ, 9AS, 9AT, 9BBF, 9BDF, 9BED, 9BLO, 9DAM, 9DCF, 9DV, 9EA, (9EL), 9FM, (9FO), 9HJ, 9HW, (9IO), 9NV, 9NX, 9WU, 9XI, 9ZL.

Spark: 1XM, 2OM, 3XM, 5LA, 5XU, 5AFG, (5AHI), 5AXG, 5AYN, 5BBO, (5BEJ), 5BEN, (5BEP), (5BFH), (5BFN), (5BIU), (5BY), (5BVH), (5CBZ), (5CGE), 5EA, 5UC, (5UR), 5XE, 5YAE, 5ZP, 9AAP, 9AGR, 9ALM, 9ASJ, 9AXU, 9CA, 9DF, 9DMJ, 9HJ, 9MS, 9UU, 9WH, 9YAK.

**8AUU, Canton, Ohio**

Spark: 1AHL, 1AX, 1ON, 1XX, 2AJE, 2BEJ, 2BFX, 2BB, 2BJ, 2FP, 2GK, 2OM, 2TF, 2XQ, 3AAB, 3AHK, 3ATZ, 3ARW, 3BEX, 3CG, 3CM, 3EL, 3FO, 3OG, 3UD, 3WJ, 3XM, 3XQ, 4AG,

4CX, 4CJ, 5HK, 5PY, 5XA, 5XB, 5XP, 5XU, 5YA, 5YE, 5YW, 5ZL, 5ZW, 5ZZ, 8AJX, 8AOH, 8AAK, 8AIZ, 8AYN, 8APB, 8AFG, 8AQF, 8AYE, 8AWT, 8AKQ, 8AXK, 8ALM, 8BIW, 8BVS, 8BFM, 8BSV, 8BXC, 8BBA, 8CLP, 8CCU, 8CGZ, 8CA, 8CP, 8DJ, 8EB, 8EL, 8EX, 8FA, 8FE, 8FZ, 8GW, 8IP, 8JJ, 8JR, 8KE, 8KG, 8KI, 8LB, 8LC, 8OE, 8OT, 8QQ, 8SP, 8TX, 8VG, 8VW, 8XE, 8XF, 8XR, 8YAE, 8YE, 8YM, 8YN, 8WZ, 8ZAE, 8ZA, 8ZP, 8ZY, 9AAP, 9AOU, 9AEK, 9ACE, 9ALO, 9ARR, 9ARG, 9AXU, 9AZA, 9AC, 9BEE, 9BP, 9CA, 9CB, 9DFX, 9DDQ, 9DCX, 9DFO, 9DSO, 9DAR, 9DIW, 9DH, 9DY, 9FM, 9FS, 9GK, 9GY, 9HR, 9IO, 9JL, 9JU, 9KE, 9KI, 9MC, 9OK, 9OX, 9QJ, 9RC, 9RY, 9SJ, 9TV, 9UU, 9WK, 9WN, 9WS, 9WT, 9WU, 9XE, 9XI, 9XM, 9XX, 9YA, 9YB, 9YC, 9YQ, 9YAE, 9YE, 9YM, 9YO, 9XAQ, 9ZL, 9ZJ.

C.W.: 1AAB, 1AGI, 1ABL, 1ARY, 1AW, 1BCG, 1BDI, 1BDJ, 1BEL, 1BEM, 1BES, 1BRQ, 1BVH, 1BKJ, 1BEI, 1BG, 1CMK, 1DF, 1ON, 1RD, 1TS, 1XA, 1XJ, 2AF, 2AYU, 2AJF, 2AAK, 2ANV, 2BEB, 2BFZ, 2BNQ, 2BEJ, 2CCD, 2JW, 2NE, 2SQ, 2VA, 2ZK, 2ZN, 3AKO, 3AAD, 3AAK, 3AAT, 3ANY, 3AQF, 3ARM, 3BER, 3BEX, 3BGV, 3BIY, 3BTJ, 3BLF, 3BEC, 3BFU, 3BAV, 3BSL, 3BRC, 3BRX, 3CBQ, 3CM, 3FS, 3IQ, 3VG, 3KO, 3RW, 3ZE, 3ZO, 3ZY, 3ZZ, 4BK, 4BY, 4EW, 4FT, 4GK, 4GL, 4KK, 4IL, 4GE, 4YA, 4YB, 4ZE, 5AAM, 5AN, 5CX, 5DQ, 5EK, 5EV, 5IX, 5JZ, 5KP, 5LA, 5NQ, 5NZ, 5PY, 5UU, 5YE, 5ZE, 6ALE, 7AA, 7DM, 8AAG, 8AQG, 8AUO, 8AFD, 8AUS, 8ANJ, 8AJT, 8AJD, 8AVD, 8AMG, 8ARD, 8ASB, 8AJV, 8ALB, 8AIM, 8ALV, 8AEV, 8AQZ, 8ASB, 8AXD, 8ABV, 8AYQ, 8ARW, 8ARQ, 8AGZ, 8AHE, 8AMF, 8APV, 8AQF, 8ASO, 8AWP, 8AZV, 8ASX, 8AZE, 8AIO, 8AXK, 8AWN, 8AJF, 8AUS, 8ARS, 8AWY, 8ADG, 8AUX, 8ATU, 8AJB, 8AWZ, 8AGZ, 8AYT, 8ALE, 8AWF, 8BEX, 8BVO, 8BDO, 8BVY, 9BOX, 8BFX, 8BNO, 8BUM, 8BUS, 8BDI, 8BEF, 8BKR, 8BPI, 8BUQ, 8BLT, 8BBW, 8BLW, 8BK, 8BO, 8BR, 8BU, 8BX, 8CEM, 8CGX, 8CAH, 8CGZ, 8CLD, 8CEN, 8CA, 8GR, 8GV, 8HD, 8JL, 8JM, 8JU, 8JW, 8NI, 8RM, 8SP, 8TX, 8VC, 8VO, 8VY, 8VB, 8WI, 8XK, 8XU, 8YAW, 8YM, 8ZAE, 8ZF, 8FG, 8ZY, 8ZX, 8ZZ, 9ASL, 9AFF, 9AXF, 9AJS, 9AKD, 9AJA, 9ALS, 9AJH, 9ANS, 9ARG, 9ATV, 9AFT, 9AYH, 9AJV, 9AYV, 9AMU, 9AAY, 9AS, 9AT, 9BJE, 9BFT, 9BW, 9BBF, 9BDF, 9BRL, 9CP, 9DEJ, 9DDW, 9DTJ, 9DTS, 9DFA, 9DAM, 9DWN, 9DB, 9DJ, 9FS, 9HK, 9HW, 9IL, 9IO, 9JL, 9JN, 9JU, 9JR, 9KP, 9NX, 9OX, 9PS, 9QA, 9QE, 9RY, 9SJ, 9WV, 9XJ, 9XT, 9XM, 9YAM, 9YAJ, 9YB, 9YC, 9ZAC, 9ZA, 9ZY.

#### 9AOG, Lawrence, Kansas

Spk.: 5AR, 5BM, (5BY), 5EH, 5EW, 5FA, 5FI, 5FO, 5HF, 5HK, 5HZ, 5IR, 5IS, 5JP, 5JR, 5KP, 5LB, 5LO, 5MF, 5NH, 5NS, 5OE, (5PG), 5PU, 5QI, 5RA, 5RW, 5TG, 5TU, 5WC, 5XA, 5XAB, 5XB, 5XJ, (5XU), (5YI), 5YL, 5ZA, 5ZAB, 5ZAG, 5ZC, 5ZL, 5ZW, 5ZZ, 7ZO, 7ZV, (8AMZ), 8ARS, 8ATU, (8AVT), 8BBU, 8BEP, 8CP, 8IN, 8JJ, 8MR, 8OH, (8QC), 8UR, 8VL, 8WO, 8ZN, (9ACL), (9AEY), (9AHZ), (9AIG), (9ALU), (9ANO), (9ANQ), (9AOJ), (9AQC), (9AR), (9ARG), (9BCF), (9BKX), (9BSA), (9CAK), (9DJB), (9ARZ), (9ASK), (9ASO), (9ATN), (9AYW), (9DGW), (9DJX), (9DLC), (9DNC), (9DSO), (9DSN), (9DTA), (9DTS), (9DVF), (9DXW), (9DZE), (9DZI), (9FU), (9HI), (9RY), (9YAK), C.W.: 1XM, 2FP, 2QR, 3AJD, 3HG, 3BEC, 3NB, 4BK, 4BQ, 4BY, 4CO, 4EL, 5EK, 5FV, 5IR, 5KP, (5KV), 5MT, 5KP, 5SI, (5YI), 5ZA, 6AIF, 6VW, 6XAD, 8AGZ, 8AIO, 8AMA, 8AMD, (8AQH), (8AQV), 8AR, 8ARD, 8AWP, 8AXK, 8BEF, 8BFX, 8BOX, 8BRF, 8BRL, (8BUM), 8BVR, 8DR, (8IQ), 8IV, (8JL), 8NI, (8OH), 8SP, 8UJ, 8VJ, 8WA, 8XV, 8ZAE, 8ZL, (9AJA), (9AJH), (9AJP), (9AMB), (9AQR), (9ARG), (9ASD), (9AUA), (9AVN), (9AYS), (9AZP), (9BBF), (9BED), (9BIZ), (9BJV), (9DDW), (9DKX), (9DPL), (9DTA), (9DZQ), (9EX), (9FM), (9JL), (9XI), (9ZL).

#### 9BMN, Sedalia, Missouri

Spark: 5AC, 5BY, 5CJ, 5EH, 5EW, 5FO, 5GI, 5HK, (5IR), (5JD), 5JF, 5KP, 5LB, 5MF, 5OF,

5PY, 5QA, 5QS, 5QQ, 5RA, 5RM, 5TG, 5TS, 5UC, 5UG, 5XB, 5XU, 5XI, 5XR, 5YG, 5ZA, 5ZAB, 5ZAG, 5ZI, 5ZJ, 8ACF, 8AFG, 8ANO, 8APG, 8ATU, 8AWP, 8AX, 8AXC, 8AXY, 8AYN, 8BA, 8EB, 8HD, 8IUY, 8JJ, 8LB, 8NZ, 8UC, 8UR, 8WO, 8XE, 8YN, 8YU, 8ZAC, (9AAG), 9AAW, 9AAP, 9AC (9ACB), 9ACL, (9ACN), 9AEG, 9AEK, 9AFW, 9AGN, 9AGE, 9AIF, 9AIG, 9AIU, 9AIX, (9AJN), 9AJF, 9AK, 9ALS, 9ALU, (9AMA), 9AMS, (9ANF), 9ANO, 9ANG, (9AOJ), 9AP, 9APB, (9APN), 9APS, 9AQA, 9AQM, 9AR, 9ARG, 9ARN, (9ARZ), 9ASK, (9ASN), 9ATN, 9AU, 9AUL, 9AUV, (9AVK), (9AVC), (9AVZ), 9AV, 9AX, 9AYW, 9AZA, 9AZE, 9BCC, 9BEP, (9BSA), 9BTN, 9BTQ, 9BUZ, 9DAG, (9DAZ), 9DCX, 9DDV, 9DDZ, 9DEH, 9DFA, 9DFX, (9DGX), 9DHz, 9DIW, (9DKQ), 9DKV, (9DLX), 9DMJ, 9DMM, 9DMP, (9DPB), 9DPH, 9DQ, 9DRO, 9DRX, 9DSO, 9DSM, 9DSO, 9DUU, 9DWP, 9DXM, 9DXT, 9DXV, (9DYO), 9DZE, (9DZI), 9DZY, 9CA, 9EE, (9FK), (9FS), 9HJ, 9HR, 9HT, 9IY, 9JAA, 9JN, 9KI, 9KO, 9LF, 9LJ, 9LW, 9MC, 9MS, 9NO, 9NE, (9OA), 9OX, 9PS, 9QJ, 9RC, 9RY, 9SC, 9TU, 9TV, 9UK, 9UU, 9UW, (9VB), (9WI), 9WT, 9WV, 9WY, 9XI, 9XM, 9YA, 9YAC, 9YAE, 9YAJ, (9YM), 9ZH, 9ZI, 9ZV.

C.W.: 2FP, 3AQR, 4BY, 5AN, 5FV, 5KU, 5NZ, 5UU, 5ZA, 8AOZ, 8AQV, 8AXK, 8AZE, 8BFX, 8BXA, 8HJ, 8JL, 8SP, 8XV, 9AAV, 9AJA, 9AJP, 9ALS, 9ARK, 9AS, 9ASD, 9ASF, 9AUA, 9BBF, 9BIX, 9BLO, 9BNO, 9BRL, 9DAX, (9DTA), 9DTM, 9DPZ, 9DYN, 9DZQ, 9FM, 9HW, 9IO, 9KP, 9LP, 9LQ, 9QY, (9SJ), 9XAB.

#### 9IO, Newport, Ky.

(1AGI), (1AZW), (1BDI), 1BEA, 1BES, (1PT), 1TS, (1XM), 1ZE, 2AAB, (2AJW), (2AWF), 2AWL, (2AWS), 2AYV, (2BB), 2BAK, (2BFZ), (2BNZ), (2BRC), 2BNJ, (2FD), (2FP), 2VA, 2ZL, 2XQ, (3AAD), 3AAE, 3AHK, (3ALN), 3AQR, 3APA, (3BA), (3BG), (3BHL), 3BLF, (3BZ), 3CA, 3CC, 3CM, (3EM), (3FM), (3FS), (3HG), (3HJ), (3KM), (3QV), (3RF), (3SQ), 3ZO, 3ZY, (BK), (4BQ), 4BY, (4DS), 4EB, 4EL, (4EN), 4EU, (4EW), (4FT), (4GL), 4ID, 4ZE, 5DA, 5EK, (5FV), 5HK, (5JB), 5KU, 5NZ, 5XA, 5ZA, 5ZX, 6XAD, (8AGO), (8AGZ), (8AIG), 8ALB, 8APN, 8APT, (8AQF), 8AQV, (8ARD), 8ARW, 8ASB, (8AWP), (8AWY), (8AWZ), (8BK), 8BO, (8BOX), (8BRL), 8BUM, (8BXA), (8BXH), (8CFP), 8CI, (8CW), 8DR, (8EA), 8II, (8JL), (8JU, 8LF, 8MP, (8NI), 8OC, 8PX, (8SP), (8UJ), (8UK), 8VJ, (8VY), 8WA, (8WI), (8WR), (8WY), 8XV, 8ZG, (8ZIE), 8ZZ, 9AAP, (9AAS), (9AAV), (9AJA), 9AJH, (9AJP), 9AKD, 9AKE, (9ALS), (9AS), (9AT), (9AUA), 9AXF, (9BBF), 9BKZ, 9BLO, 9BRL, (9DGF), 9DDW, (9DTJ), (9DTW), 9DUN, (9DV), (9DYN), 9EL, (9IZ), 9JL, 9KP, 9NX, 9OO, 9PS, 9QE, 9SJ, 9US, (9UW), 9WU, 9XAG, 9XI, 9ZAC, 9ZAF, 9ZL.

#### 9BLD, McLean, Ills.

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C.W.: 4BQ, 5FV, 5HR, 5KV, 5UU, 5ZX, 6ZZ, 8AGZ, 8AIG, 8ASM, 8BOX, 8CLD, 8AAO, 9AAU, 9AJA, 9AJH, 9AKR, 9ALS, 9AS, 9AWM, 9AX, 9AWM, 9AX, 9BBE, 9BBF, 9BED, 9BEG, 9BIZ, 9BLO, 9BNO, 9DBV, 9DCI, 9DCR, 9DHB, 9DKX, 9DWS, 9DYN, 9HK, 9KP.

## A STORM RELAY ROUTE

(Continued from page 87)

Chicago. Work was started at once by 9XI, 9ZT and 9AJF, the latter two stations on C.W. At 10 a.m. communication was established with 9DR at Buffalo, Minn., and as that station has a very favorable location it was used as a central station the remainder of the day. Mr. Wallace at Buffalo raised 9MF at St. Cloud and 9QE at Fairmont (all C.W.) before noon. At noon St. Cloud was in touch with Brainard and with 9BAC to the north of there. Fairmont on the other hand had gotten in touch with New Ulm, Minn., and before the end of the afternoon had also established the network to 9YAE in Le Mars, Iowa. The entire system was checked every hour. Le Mars was in touch with Davenport and through him to Roodhouse, Ill., 9MC, at 4:00 p.m., when the re-establishment of the telephone line removed the necessity of longer maintaining the network just as Chicago traffic was about to be started.

Although there was a wire line through to Chicago it was not capable of handling any more than official communication service of the company and they could not touch any news service so the amateurs were again asked to help. The two sta-

tions 9XI and 9ZT with the wonderful "silent co-operation" of the rest of the Twin City amateurs set out to get into communication with Chicago. This was done at 11:30 and the press service was just about to file with the radio station in Chicago when once more the lines were restored. In the meantime the evening press from NAA had been copied and given the papers. This matter was gladly used and the amateurs were given over a column of space on the front page on the Minneapolis Tribune and other Twin City papers.

The real value of the entire affair is in the fact that such a communication network could be built up and maintained in daylight by amateurs without any previous arrangement. *That Citizen Radio can serve in an emergency is an undisputed fact* in the Twin Cities and thereabouts. Much credit is due to the stations establishing this network and especially to Mr. J. F. Carpenter of 9XI, managing the city of Minneapolis, for his early grasp of the situation, intelligent routing of messages, and his fortitude in sticking on the job forty hours without sleep.

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Type DXA—305—Mahogany Finish Case

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with the new

### USL "A" Battery

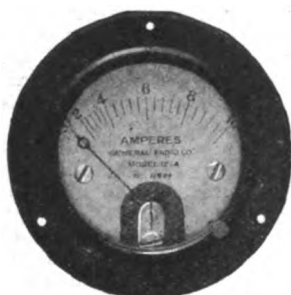
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Type 127A



Type 127B

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Send 5 cents for catalog F

Dealers: We have a very interesting plan of co-operation.

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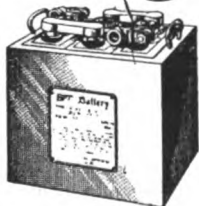
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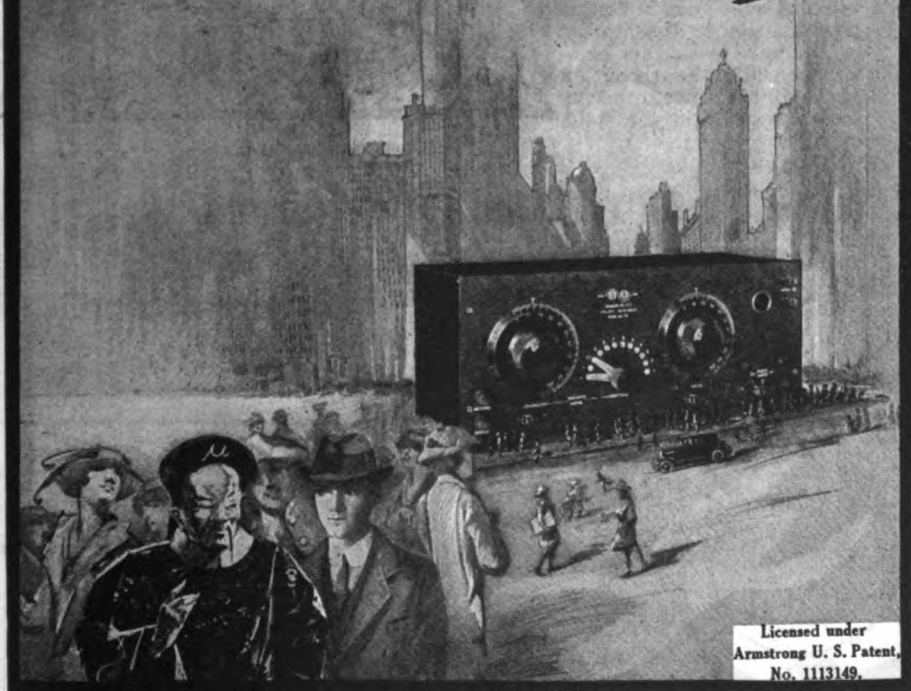


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“He who wishes  
to know the road  
through the mountains  
must ask the  
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In seeking  
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in Radio,  
let GREBE be  
your guide.

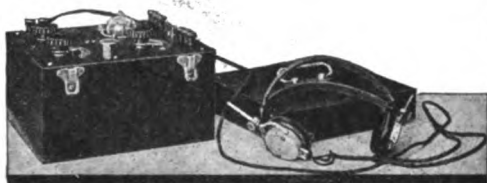
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## To Receive Broadcasting Radiophones

### The Radiohome Receiver



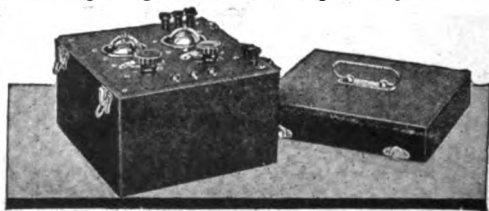
The Radiohome Receiver

### The DT-800 Amplifier

Every amateur is frequently being asked for advice as to what set should be purchased for the reception of radio telephone programs of music, news and stories. Many an amateur hesitates to recommend standard amateur equipment as his friends would be confused and bewildered by the array of controls on such a set.

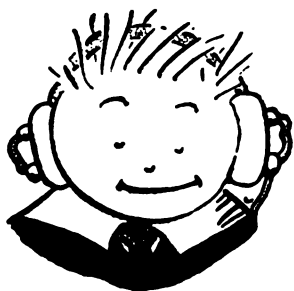
We illustrate two pieces of radio receiving apparatus which will, doubtless, appear unfamiliar to the amateur field. Yet we have been manufacturing these sets for some time—for the general public.

The Radiohome Receiver has a simple, two-slide tuning circuit with a range of 145-800 meters, a vacuum tube detector, and grid leak and rheostat. The price—less tube, batteries, receivers and antenna—is \$36. In a cabinet that is identical in size and finish with the cabinet of the Radiohome, is the DT-800, two-step amplifier. Three phone jacks are embodied in this instrument for detector, 1st step and 2nd step. Less tubes and batteries the price is \$35. We believe you will find no other set on the market to compare with this combination for the reception of radiophone programs by the newcomer in the field.



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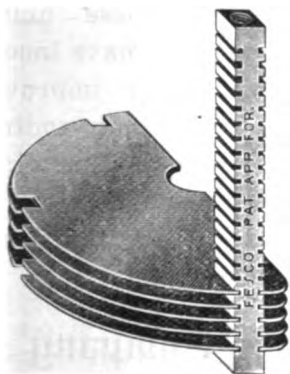
**FESCO  
BRAND**

# AT LAST

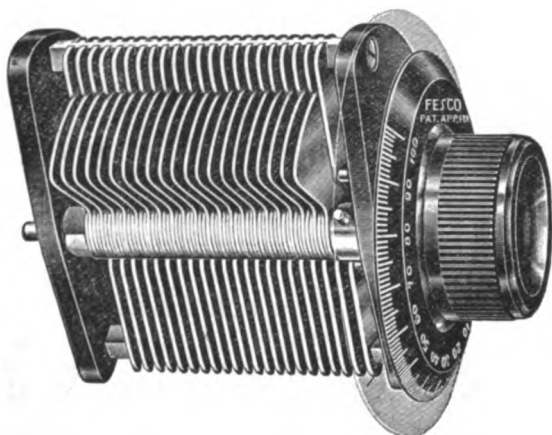
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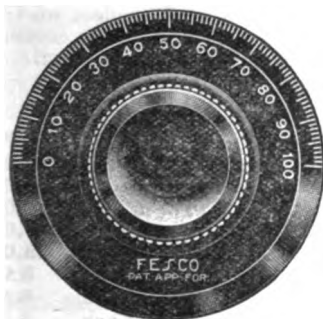
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Genuine Bakelite  
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### Fesco Dial

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| 43 Plate Cond. less dial        | 4.75   |
| 23 Plate Cond. with dial        | 4.75   |
| 23 Plate Cond. less dial        | 4.00   |
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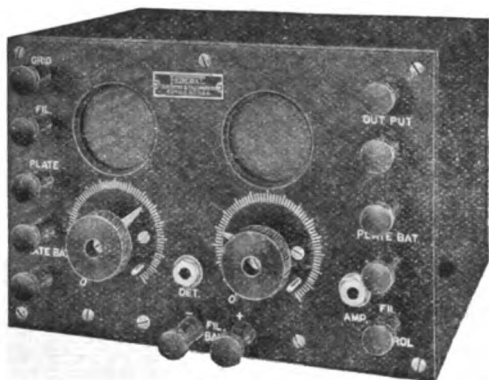
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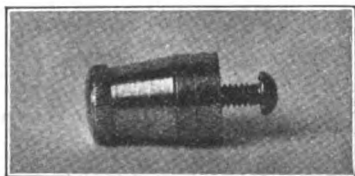
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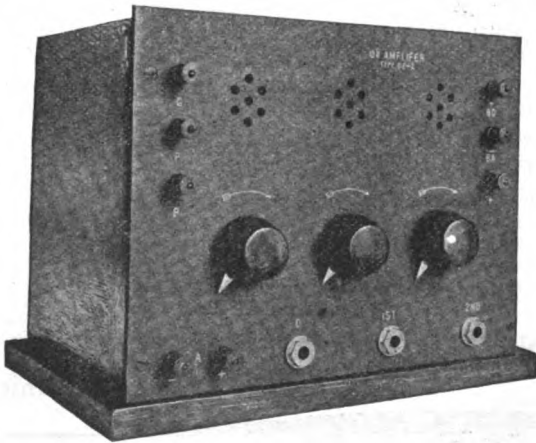
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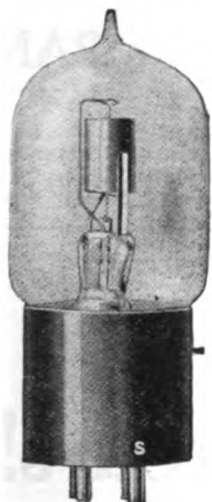
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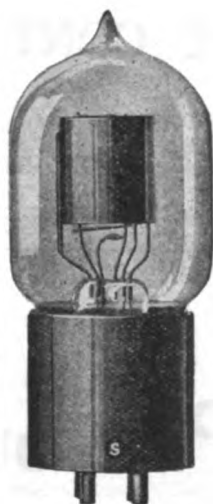


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**Copper No. 14 per lb. .... .60**  
(about 90 ft.)

**REYNOLDS RADIO CO. Inc. 613 19th St., DENVER, Colo.**

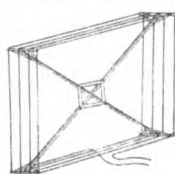
**DISTRIBUTORS**

**Dealers Write for Proposition**

**High-Grade  
WIRELESS  
HEAD RECEIVERS, MICROPHONES,  
KEYS, JACKS, PLUGS, ETC.**

***American Electric***

**Manufacturers COMPANY CHICAGO, U.S.A.**



### RECEIVE ON AN Indoor Coil Aerial

Chart and tables giving proper number of turns to put on coil for any wave lengths covering 0 to 3600 meters 50c; 3600 to 24000, 50c. Stamps not accepted. **C. A. DAVIS & CO.,** 2371 Champlain N. W., Washington, D.C.

# MURDOCK

## *radio necessities*

---



No. 56 Phones

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$5.00 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

*Buy Murdock apparatus from your dealer.*

---

# WM. J. MURDOCK Co.



**\$5.00**

## "IT SPEAKS FOR ITSELF" ARKAY LOUD SPEAKER RADIO HORN

Make your own Loud Speaker by simply inserting one of the 'phones from your head set.

The Arkay Radio Horn is so designed as to reproduce signals, speech and broadcasted music without distortion, giving a pure and natural tone.

The Arkay Horn is carefully constructed of brass throughout, finished in either black, hard rubber finish, or full polished nickel as desired.

Its construction is such that it will fit any of the popular makes of radio receivers. This is accomplished by means of an adapter concealed under the base, which is provided with an opening to permit the horn to set over the receiver cord. Construction of the adapter is sufficiently rigid to prevent vibration, thereby eliminating any overtones or distortion of signals, speech or music.

Arkay Horns work equally well on one or two stages of amplification.

If not obtainable at your dealers, we will forward one direct, upon receipt of purchase price, plus the postage to your station.

Shipping weight 4 pounds.  
Price, Black enamel, without 'phone \$5.00 each  
Polished nickel without 'phone 6.00 each

Dealers write for our proposition. Immediate delivery.

### DISTRIBUTED BY

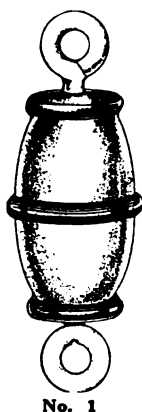
Indianapolis, Ind.  
Hatfield Electric Co.  
Newark, New Jersey.  
Economy Auto Supply  
Co., Inc.  
Radio Distributing Co.  
Pittsburgh, Pa.  
Ludwig Hommel & Co.  
Robbins Electric Co.

New York City  
Continental Radio &  
Electric Corp.  
Manhattan Electrical  
Supply Co., Inc.  
Ship Owners Radio  
Service, Inc.  
Toledo, Ohio  
Marshall-Gerken Co.

MANUFACTURED BY

**RILEY-KLOTZ MFG. CO., 21 Mulberry St., Newark, N. J.**

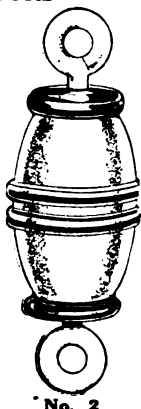
## WIRELESS DISTRIBUTORS



No. 1

Handle  
B. & P.  
INSULATORS

Aerial  
Necessity  
Insures  
Safety  
and  
Perfect  
Insulation



No. 2

**Immediate Delivery**

Write for Exclusive Territory  
and Quotation

**Banister & Pollard Co.**

206-208 Market St.,

Newark, N. J.

## HYGRADE SPECIALS

*Save You Money*

|  |      |
|--|------|
| 7 Stranded Copper Aerial Wire                        |      |
| 100 Feet .....                                       | .85  |
| Radio Service V.T. Sockets....                       | .80  |
| Crosley V. T. Sockets .....                          | .55  |
| 22½ V. Cyclone Small B Battery ..                    | .90  |
| 22½ V. Cyclone Large B Battery ...                   | 1.60 |
| 22½ V. Eveready B Battery .....                      | 1.50 |
| 45V. Cyclone Large Variable B<br>Battery .....       | 2.75 |
| 22½ V. Large Eveready Variable<br>B. Battery .....   | 2.50 |
| Binding Posts (rubber Cap) per doz.                  | .75  |
| .0005 MF. Grid Condensers .....                      | .25  |
| .002 MF. Phone Condensers .....                      | .25  |
| Variable Grid Leaks ½ to 3 meg-<br>ohms .....        | .65  |
| Electrode Ball Insulators 28c each,<br>per doz. .... | 3.00 |

### Marko Storage Batteries

|                      |       |
|----------------------|-------|
| 6 Volt 40 Amp. ....  | 10.00 |
| 6 Volt 60 Amp. ....  | 13.50 |
| 6 Volt 80 Amp. ....  | 17.00 |
| 6 Volt 100 Amp. .... | 21.50 |

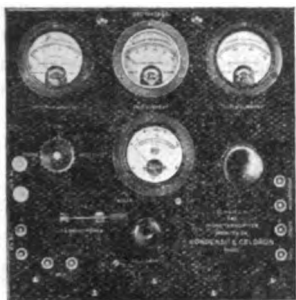
*We do not charge for crating  
Above batteries are fully charged when Shipped. The above  
prices are F. O. B. New York.*

**Hygrade Electrical Novelty Co.**

41 West 125th Street.

New York.

# Condensite



**I**F the molded insulation of your radio set is made of Condensite and the panel of Condensite-Celoron, you will have a combination that for appearance and lasting service will have no equal.

No other material possesses in such a high degree the properties essential to radio insulation.

We do not manufacture finished parts but upon request will gladly send the names of the leading radio concerns who make their instruments of Condensite.

Condensite-Celoron is a waterproof fibre especially adaptable for panel work.

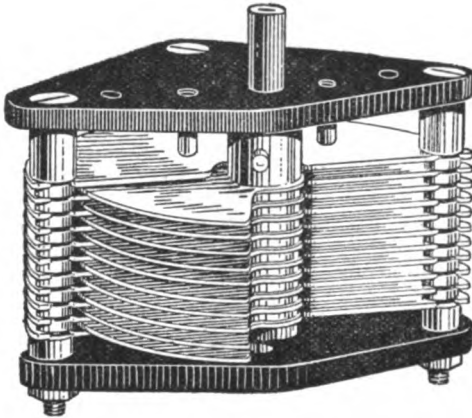
It can be obtained in sheets, rods and tubes of standard size; in two colors, brown or black, from the Diamond State Fibre Company, Bridgeport, Penna.

**CONDENSITE COMPANY OF AMERICA**

**BLOOMFIELD NEW JERSEY**

# HECO

## VARIABLE CONDENSERS



Made in 23 and 43 plate. Spacing of plates and casting of pillars and plates give uniform capacity at all times. Spring bearings assure even tension and good contact. Parts made and assembled under direct supervision of our radio engineers.

We can positively guarantee 24 hours shipments on all orders.

#100 23-plate .0005 MFD List \$4.00  
#200 43-plate .001 MFD List \$4.50  
Prices do not include knob, dial, or scale.

Special proposition open to jobbers and dealers.

**HATFIELD ELECTRIC COMPANY**  
INDIANAPOLIS, IND.

**QST de ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Pa., successor to Shotton Radio Mfg. Co., of this city.**

We wish to announce that we will carry at all times, a complete line of parts, as well complete sets representing the leading manufacturers.

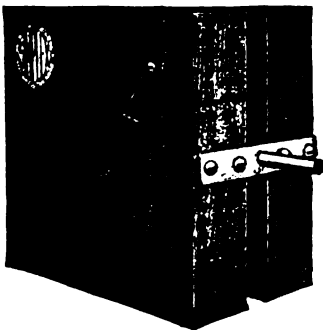
**Service - is our watchword.**

A Trial will convince you.

Send 5c. for our catalog of Parts

**ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Penna.**

## VARIOMETERS AND VARIOCOUPERS

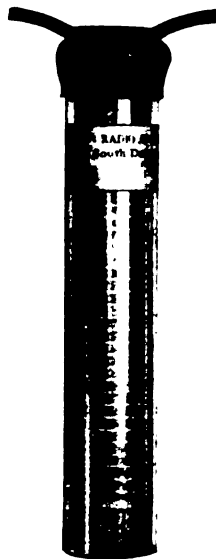


These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base. Variometer as illustrated ..\$6.00  
Vario-Coupler as illustrated 6.00  
Round or Square Base

Get them at your dealer's.  
**SIMPLEX RADIO CO.**  
1013-15 Ridge Av., Phila. Pa.



# "Chi-Rad" Apparatus



## New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

Simple and easy to re-charge from your lamp socket

Price per cell \$0.50  
Add PP on  $\frac{1}{4}$  lb.  
per cell.

and will last for years with ordinary use.

### SPECIFICATIONS:

Cut shows cell one half natural size.

Voltage per cell 2 volts.

Pasted Plates—ready formed for initial charge.

High Ampere Hour capacity—will operate one detector tube 1000 hours with one charge.

Shipped dry with simple directions for preparing the electrolyte.

**Mahogany Tray for holding ten cells \$1.00 extra**

**Dealers:—Get our discounts on this new Battery—your customers will want them!**

### REMOVAL NOTICE

About April 1st we will move to 415 South Dearborn Street where we will open a High-Grade Ground Floor Salesroom. With greatly increased space we will carry every make of good Radio Apparatus and will endeavor to have

**"The Finest Radio Retail Salesroom in Chicago."**

**CHICAGO RADIO APPARATUS CO., Inc.**

415 South Dearborn Street,

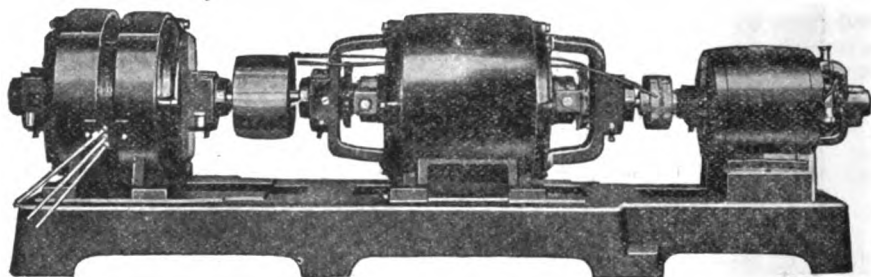
Chicago, Ill.

TRADE **E S C O** MARK

MEANS THE LAST WORD IN  
**MOTORS, DYNAMOTORS, GENERATORS, MOTOR GENERATORS**  
Designed and Developed by **PIONEERS**  
In Perfecting High Voltage Apparatus for Wireless Operation

## **ESCO PRODUCTS ARE STANDARD**

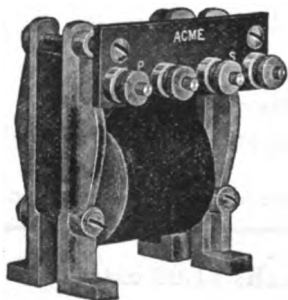
Sold by **PRINCIPAL DEALERS** Everywhere  
Used by **LEADING EDUCATIONAL** Institutions



This Outfit Enabled 1BCG—GREENWICH, CONN., to be among the first to get across the Atlantic in the recent Amateur Contest

Ask for Bulletin 237  
Listing over 200  
Combinations.

**ELECTRIC SPECIALTY COMPANY**  
215 South St., STAMFORD, CONN., U.S.A.



### ***Amplify your signals with ACME Transformers***

Acme Transformers in your vacuum tube amplifier equipment, magnify voice and music as well as code without distortion and without howling. They are priced as low as specialized quantity production permits, with due regard for quality. At all Radio dealers.

**Acme Apparatus Co.**

194 Massachusetts Ave.,  
Cambridge, Mass.  
*Transformer and Radio Engineers and  
Manufacturers*

# HERE

## **RADIO CITIZENS**

Complete stocks carried for immediate shipment of the following apparatus:

Grebe                      Murdock  
DeForest                Adams-Morgan  
Acme                      Radio Corporation  
C. Brandes, Inc.  
Federal Telephone & Telegraph Co.

### **FREE BULLETIN PRICE LISTS**

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed **FREE** on your request. Send for them today.

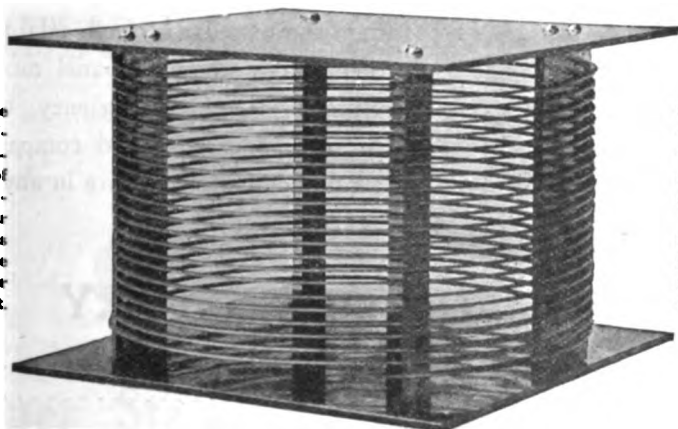
**Nash Electrical Service Co.**  
Marshall, Ill.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



# We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the WIMCO INDUCTANCE assures you of maximum results from your CW outfit. Its low resistance means greater antenna output.



Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size \$10.00, Grid Coil \$2.00 extra.

**WIMCO CW 100 INDUCTANCE**

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aerials at 200 meters wave length;

| Wave length | H. F. Resistance |
|-------------|------------------|
| 150         | .71 ohms         |
| 200         | .85 ohms         |
| 250         | .95 ohms         |

(effective inductance 80.5 microhenries at 200 meters)

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

**ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER.** We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price \$5.00 fully mounted and thoroughly guaranteed. **DEALERS—JOBBER WRITE.**

**REMLER APPARATUS—CUNNINGHAM TUBES—FROST REGENERATIVE RECEIVING SETS—CLAPP-EASTHAM AND FEDERAL PRODUCTS—HIPCO PLATE BATTERIES—WORKRITE VARIOMETERS AND COUPLERS—KLOSNER VERNIER RHEOSTATS—FADA APPARATUS—BRANDES AND BALDWIN HEADSETS**

## 8ZV WIRELESS MANUFACTURING CO. 8ZV

**CANTON, OHIO**

**JOBBER—MANUFACTURERS**

## Chelsea No. 50 Amplifying Transformer



Was designed for use with the present day models of vacuum tubes, and when so used produces remarkable amplification, with minimum noise. It is well adapted for table mounting or may be panel mounted in any position. Its high efficiency together with its neat appearance and compactness, makes it a predominating feature in any radio receiving equipment.

### IMMEDIATE DELIVERY

Price as shown ..... **\$4.50**  
Unmounted ..... **3.75**

*Bulletins sent upon request*

*Purchase from your dealer. If he does not have it, send to us.*

### CHELSEA RADIO COMPANY

160 FIFTH STREET,

CHELSEA, MASS.

### RAY-DI-CO PRICES DEMAND QUICK ACTION! LET YOUR EYES TRAVEL OVER THESE SPECIALS, THEN ACT!

RAY-DI-CO Variometer Set \$13.50

Completely set up. Consists of two Variometers and one tapped variocoupler. Only the highest grade mahogany used in forms,—non-shrinking, non-cracking, limit stops on rotor. No grating sounds from sliding contacts.

**\$10.00 Knocked down complete with hardware.**

#### FORMICA PANELS

|                           |        |                            |        |
|---------------------------|--------|----------------------------|--------|
| 9x14x $\frac{1}{8}$ ..... | \$1.75 | 9x21x $\frac{1}{8}$ .....  | \$2.25 |
| 9x14x $\frac{1}{4}$ ..... | 2.50   | 9x21x $\frac{1}{4}$ .....  | 3.75   |
| 7x18x $\frac{1}{8}$ ..... | 1.75   | 12x21x $\frac{1}{8}$ ..... | 2.75   |
| 7x18x $\frac{1}{4}$ ..... | 2.50   | 12x21x $\frac{1}{4}$ ..... | 5.00   |

**IMMEDIATE DELIVERY.** Mail orders given prompt attention. *If your dealer cannot supply you order direct from this ad.*

### THE RAY-DI-CO ORGANIZATION

1547D N. WELLS STREET,

CHICAGO, ILL., U.S.A.

## KECO-RADIO STORAGE BATTERIES

Are the highest grade batteries built especially for wireless instruments.



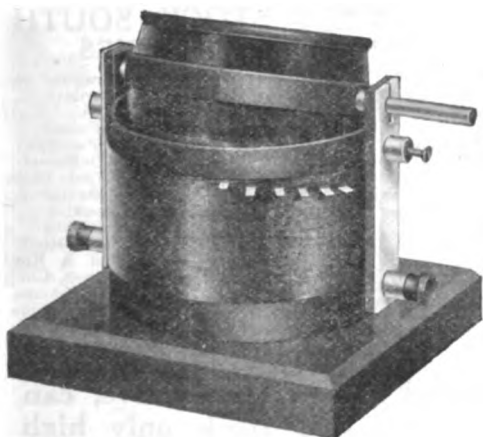
Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristol" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, 15.75, with book of uses and abuses of the storage battery.

### KALB ELECTRIC COMPANY

7323 MANCHESTER AVENUE,

ST. LOUIS, MO.



**Price**

**\$5.00**

## **Super Standard Vario Coupler**

Single turn variations cover entire primary winding on the Formica tube. For both table and panel mounting.  $\frac{1}{4}$ " Brass rods in Rotors. Binding post connections. Green silk wire. Range 150-600 Meters.

**New Knob and Dial \$1.00—Sockets \$1.00**

**IMMEDIATE DELIVERY**

**New Non-Regenerative Set**

**In cabinet with detector unit included**

**\$32.50**

**MANUFACTURERS—JOBBER—DEALERS**

## **OUR NEW CATALOG IS READY**

Our new catalog is ready with complete descriptions and illustrations of our entire line VARIOMETERS, VARIOCOUPLERS, DETECTORS, AMPLIFIERS, DIALS, SOCKETS, RHEOSTATS, NON-REGENERATIVE RECEIVING SETS, BINDING POSTS, CONTACT KNOBS, STOP PINS, SWITCH LEVERS COMPLETE AND SMALL ACCESSORIES

**We are territorial Distributors for Radio Corporation, Westinghouse, Magnavox, Baldwin, Remler, Cunningham, Riley-Klotz "ARKAY HORN", Federal, Rhamstine, Acme, Weston and Jewell Meters, Hipco B Batteries, Cooper storage Batteries, A. P. Tubes, etc.**

**Send us your Orders for Head Sets, Dials and Knobs, Sockets, Magnavox, Arkay Horns.**

# **THE MARSHALL-GERKEN CO.**

**Manufacturers & Jobbers**

**TOLEDO**

**OHIO**



**ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS**

# RADIO APPARATUS

**LARGEST STOCK SOUTH  
PROMPT DELIVERIES**

## SERVICE

## QUALITY

|  |        |
|--|--------|
| B. Batteries Radisco Small 22½ V. ....         | \$1.50 |
| B. Batteries Radisco large-tapped 22½ V. ....  | 2.65   |
| B. Batteries Eveready large-tapped 22½ V. .... | 3.00   |
| Tubes UV200 Radiotron Detector .....           | 5.00   |
| Tubes UV201 Radiotron Amplifier .....          | 6.50   |
| Tubes UV202 Radiotron Trans-5 watt .....       | 8.00   |
| Tubes UV203 Radiotron Trans. 50 watt .....     | 30.00  |
| Tubes C300 Cunningham Detector .....           | 5.00   |
| Tubes C301 Cunningham Amplifier .....          | 6.50   |
| Tubes Electron Relay Detector .....            | 5.00   |
| Tubes A & P Amplifier .....                    | 6.50   |
| Phones Murdock 2000-ohm .....                  | 4.50   |
| Phones Murdock 3000-ohm .....                  | 5.50   |
| Phones Brandes Superior .....                  | 8.00   |
| Phones Brandes Navy .....                      | 14.00  |
| Phones Baldwin Type C .....                    | 12.00  |
| Phones Baldwin Type E .....                    | 13.00  |
| Phones Baldwin Type F .....                    | 14.00  |

|                                    |        |
|------------------------------------|--------|
| Sockets Paragon .....              | \$1.00 |
| Sockets Murdock .....              | 1.00   |
| Sockets G. A. ....                 | 1.50   |
| Sockets DeForest .....             | 1.20   |
| Rheostats Paragon .....            | 1.50   |
| Rheostats DeForest .....           | 1.65   |
| Rheostats Gen. Radio .....         | 2.50   |
| Rheostats Remler-Jr. ....          | 1.00   |
| Remler Rheostat .....              | 1.50   |
| Rheostats Parkin .....             | .75    |
| Corwin Dial & Knob 3" .....        | 1.00   |
| Corwin Dial & Knob 3½" .....       | 1.20   |
| Dial and Knob Chelsea .....        | 1.00   |
| Transformers, Acme Unmounted ..... | 4.50   |
| Transformers, Acme Sem-mtd. ....   | 5.00   |
| Transformers, Acme Mounted .....   | 7.00   |
| Transformers, Federal .....        | 7.00   |
| Transformers, UV712 .....          | 7.00   |

**We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.**

Acme Apparatus  
Clapp-Eastham  
DeForest  
Wm. Murdock

Federal  
Firth  
Radio Dist. Co.  
Radio Corp.

Brandes  
Adams-Morgan  
Chelsea  
Magnavox

Remler  
Signal  
Eveready  
N. Baldwin Co.

## ROSE RADIO SUPPLY

604 GRAVIER STREET,

NEW ORLEANS, LA.

Send 10c for Catalog



## Galena and Radiocite

Million point, supersensitive crystals from our own mine in Arizona. Used by all radio companies.

## Radio Supplies BY MAIL

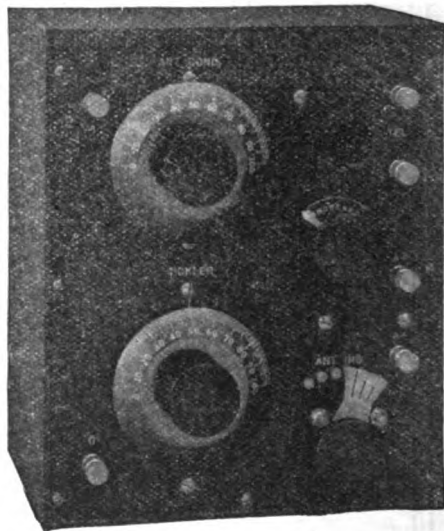
Crystals, mounted 30c, unmounted 25c.  
Condenser, fixed receiving ..... \$1.00  
Insulators, aerial ..... .25  
Binding Posts ..... .07c. up  
Contact points ..... per 1000 \$15.00  
Tuning Coils ..... \$3.50 & \$4.00

Mail orders promptly filled. All crystals carefully tested and inspected.

**The RADIO SHOP of NEWARK**

**41 So. Orange Ave.,  
Newark, N. J.**

## Clapp Eastham H R tuner



This tuner brings all the  
**RADIOFONE BROADCASTING**  
to your home. See it in Akron, Ohio, at  
**The Radioart Store**  
318 Ohio Bldg. Radio 8UX

# Greater Amplification

*Than Any Other On The Market !*

**NO HOWLING !**

**No Plate Circuit Tuning Adjustments**

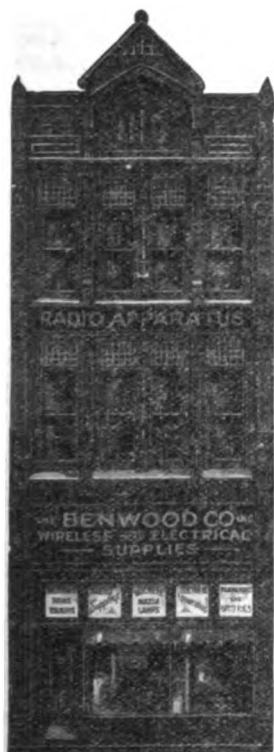
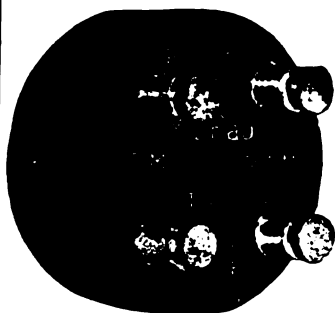
**Equally Effective on Phone, C.W. or Spark.**

**Radio Frequency Amplification at Short Wave Lengths.**

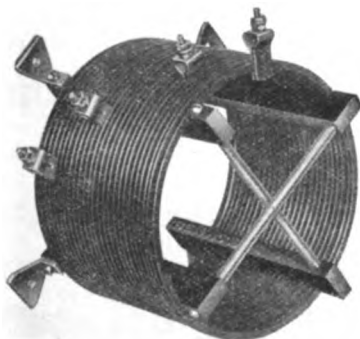
Here is a new departure in Radio Transformers. MU-RAD combines REGENERATION and straight R. F. AMPLIFICATION in a single unit. Type T-11 shown above can be used with any type of tube. With diagrams and full instructions, \$9.00 each.

**Our Guarantee**

We guarantee our T-11 Transformers to give greater amplification than any other on the market when properly used or you receive your money back.



THE above photo shows our new 3-story building in the heart of the St. Louis business district. Our mail order department is complete in itself and we give you immediate service on all mail orders. Send 10c in stamps for our catalog today.



**The Only "CW"  
PANEL  
INDUCTANCE  
On The Market**

This is the only "C.W." Inductance made for panel mounting. The copper ribbon is wound on FORMICA supports, giving highest possible insulating qualities. Each Inductance furnished with four of the new type BENWOOD PATENTED HELIX CLIP which will fit either a round or flat surface. Each clip furnished with moulded insulated handle which enables tuning of the set with current on.

Standard size, as shown in cut, consists of 25 turns of edgewise wound soft drawn copper strip  $\frac{3}{8}$ -inch in width and  $\frac{1}{8}$ -inch in thickness. Turns are full 6-inches in diameter. Type A-1 (as shown)—each \$8.50. Type A-2—50 turns, ideal for stations requiring more than 250 meter wave, price each \$12.50.

**For Prompt Shipments—BENWOOD  
"World Wide Mail Order Service"**

Our enormous mail order business has built up because of the service we render our customers. Your order will be filled at once or letter of notification will be sent you the same day explaining any cause for delay. Send 10c in stamps for the new Benwood Radio Catalog which comprises the latest price directory. We can show you how to save money by buying from us direct by mail.

**THE BENWOOD CO., INC., 1114 OLIVE STREET  
ST. LOUIS, MO.**

# T & H Radio Company

**Largest Radio Stock In Mid-West**

**Immediate Deliveries**

All items listed are in stock in large quantities.

## CW APPARATUS

|                                 |        |
|---------------------------------|--------|
| UV202 5 watt Radiotron .....    | \$8.00 |
| UV 203 50 watt Radiotron .....  | 30.00  |
| UV216 Kenotron Tubes .....      | 7.50   |
| UV217 Kenotron Tubes .....      | 26.50  |
| UR542 Porcelain Socket .....    | 1.00   |
| UR541 Porcelain Socket .....    | 2.50   |
| PR535 Filament Rheostat .....   | 3.00   |
| PR537 Filament Rheostat .....   | 10.00  |
| UP1719 Grid Leak .....          | 1.10   |
| UP1718 Grid Leak .....          | 1.65   |
| Acme CW Inductance .....        | 8.00   |
| Acme 200 Watt CW transformer .. | 20.00  |
| Acme 500 Watt Power Trans....   | 25.00  |
| Acme Choke Coils, single .....  | 6.00   |
| Acme Choke Coils, double .....  | 8.00   |
| Acme Modulation Transformer ... | 5.00   |

## RECEIVING APPARATUS

|                                   |        |
|-----------------------------------|--------|
| UV200 Radiotron, detector .....   | \$5.00 |
| UV201 Radiotron, amplifier .....  | 6.50   |
| Electron Relay, detector .....    | 5.00   |
| A. P. Amplifier tube .....        | 6.50   |
| Grebe CR9 with amplifier .....    | 130.00 |
| Grebe CR8 150-1000 meters .....   | 80.00  |
| Grebe CR5 150-3000 meters .....   | 80.00  |
| Magnavox, 14" horn .....          | 45.00  |
| Burgess #2156 "B" Battery ..      | 3.00   |
| Burgess Tapped "B" Battery ...    | 2.75   |
| Baldwin Receivers type C .....    | 12.00  |
| Baldwin Receivers type E .....    | 13.00  |
| Baldwin Receivers type F .....    | 14.00  |
| Brandes "Superior" receivers .... | 8.00   |
| Acme Amplifying transformers ..   | 5.00   |
| Honey Comb Coils, all sizes       |        |

Inquire for monthly stock sheet, shows our complete stock each month. ...CW and radiophone catalog sent any address when four cents in stamps accompanies inquiry.

5th District Distributors for Ideal Apparatus Co.

# T & H Radio Company

**ANTHONY,**

**9ZAC**

**KANSAS**

## RADIO PANELS

**SAVE MONEY** on our special 30 day offer. Our panels are made of genuine

## BAKELITE DILECTO

XX Grade Black (Polished Surface)

used for the past 5 years as a standard WIRELESS insulation by U.S. Navy. Universally recognized by radio engineers as the most efficient insulation for radio sets. We are specialists dealing exclusively in radio panels and have ready for immediate delivery the following sizes— $\frac{1}{8}$  inches thickness.

|                    |                     |
|--------------------|---------------------|
| 6 x 9 Price \$1.15 | 6 x 19 Price \$3.40 |
| 6 x 12 " 1.50      | 12 x 18 " 4.50      |
| 8 x 12 " 2.00      | 6 x 21 " 2.60       |
| 6 x 18 " 2.25      | 12 x 14 " 3.50      |
| 9 x 12 " 2.25      |                     |

We will cut special sizes to your specifications at 2½ cents square inch.

### RADIO PANEL SPECIALTY CO.

Sales Office: 50 Church St., Room 1869, New York City

Enclosed find \_\_\_\_\_ for \_\_\_\_\_ Bakelite Panels \_\_\_\_\_

size \_\_\_\_\_

NAME \_\_\_\_\_

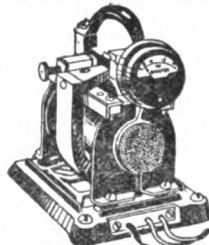
ADDRESS \_\_\_\_\_

CITY OR TOWN \_\_\_\_\_

STATE \_\_\_\_\_

## 10c. Charges Your Storage Battery AT HOME WITH AN F-F Booster

So You will never have to give up, in disgust when



working a distant station. Is it not gratifying to feel that your filament battery will always be ready when you want it? You know what its like to have friends call to "LISTEN IN" & then find your battery dead. F-F Battery Boosters are automatic and operate unattended. Screw plug in lamp socket, Snap Clips on Battery Terminals and see the gravity come up. The AMMETER shows you

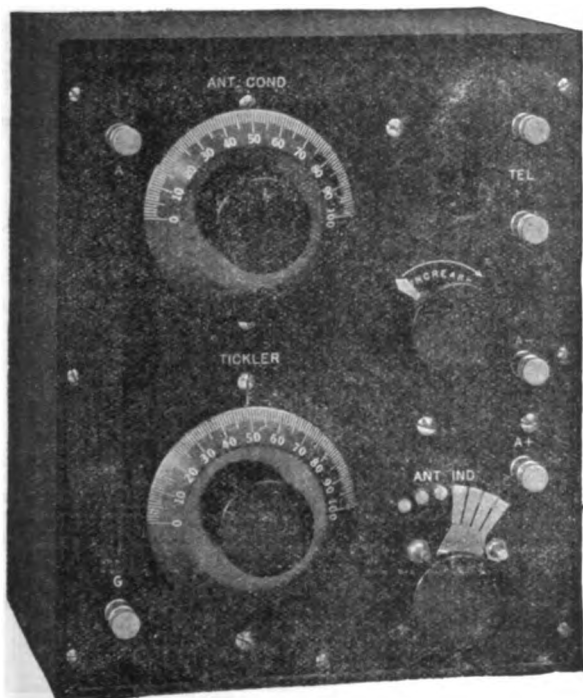
just the amount of current flowing. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes which maintain a constant efficiency and last for thousands of hours. Everything Complete in One Compact, Self-Contained, Portable Charging Unit. F-F Boosters are Magnetic Rectifiers for 105-125 Volt 60 Cycle Alternating Current. PRE-WAR PRICES: Bantam Type 6 charges 6 Volt Battery at 6 Amperes \$15 Bantam Type 12 charges 12 Volt Battery at 5 Amperes \$15 Type 166 Charges 6 Volt Battery at 12 Amperes \$24 Type 1612 Charges 12 Volt Battery at 7 Amperes \$24 Type 1626 Charges Both 6 and 12 Volt Batteries \$36 Shipping Weights Complete 12 to 15 Pounds

Order from your Dealer or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage and Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge batteries from Farm Lighting Plants, Direct Current Circuits and D.C. Generators. For Group Charging use our Full Wave Automatic F-F Rotary Rectifier of 100 Volt, 36 cell capacity. Order Now or Write for Free BOOSTER Bulletin No. 31 or ROTARY 31A

**The France Mfg. Co. CLEVELAND, OHIO, U.S.A.**

Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

# Here's The Receiving Set You Are Looking For—



Licensed Under Armstrong U. S. Patent  
No. 1,113,149

The specifications tell the story to the expert and the C-E guarantee of satisfaction protects every purchaser of a Clapp-Eastham Type H. R. Regenerative Receiving Set—expert and amateur alike.

If you're looking for 100% satisfaction—regardless of price—ask your dealer to show you this set. He may be temporarily out, but it's well worth waiting for—or you can write us direct.

If you haven't already received a copy, you should send 6c in stamps for the C-E Radio Catalog—it covers every essential radio requirement.

## THE CLAPP-EASTHAM TYPE H. R. REGENERATIVE RECEIVER

PRICE \$40.00

You can pay more money for a receiving set—if you want to—but you can't get any better results or greater satisfaction at any price.

Since we put this set on the market, we've been literally swamped with orders. Dealers, radio "fans," novices—everybody who has tried the instrument has become a booster for it.

Regeneration is perfect on all wave lengths between 180 and 825 meters. The range or distance from which signals are received and the clear, sharp tones are a revelation to the experienced radio man as well as to the person who "listens in" for the first time.

*Panel-- Formica, handsomely decorated.*  
*Cabinet -- Solid Mahogany.*  
*Condenser -- Balanced type, 2 Rotary, 3 Stationary plates. Built on Verker.*  
*Dials -- Indestructible metal. White figures on black ground.*  
*Antenna Inductance-- Wound in Formica Tube.*  
*Plate Inductance -- Wound on molded ball.*  
*Binding Posts-- Black rubber covered.*  
*Switch-- Fan Blade.*  
*Rheostat-- C. E. Type H 400.*  
*Circuit -- Single circuit regenerative. Licensed under Armstrong U. S. Patent No. 1113149.*  
*"B" Battery -- Contained in compartment inside cabinet or external as desired.*

## CLAPP-EASTHAM COMPANY

RADIO ENGINEERS and MANUFACTURERS

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127-20

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Send to KLAUS—"Radio Headquarters" for special discount lists and bulletins on apparatus and equipment. Our service department offers dealers assistance and advice on radio problems. We distribute "tested" apparatus. We know the equipment we send you is right. We want all Agents and Dealers to get our special proposition on the best lines of apparatus made.

Get our Prices on these lines of apparatus

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Adams-Morgan  
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DeForest  
Jewell  
Federal  
Radio Corporation

Grebe  
Moorhead  
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Write today to---

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Eureka,

Illinois



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We beg to announce our appointment as distributors for  
**BALDWIN, BRANDES, MURDOCK, CLAPP-EASTHAM, CHELSEA,  
FIRTH, A B C, DEFOREST, MARSHALL-GERKEN and others**  
**SPECIAL THIS MONTH**

Bakelite Cut any size— $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$ , 1  $\frac{1}{2}$  c, 2c and 2  $\frac{1}{2}$  c per square inch.  
Mail Orders Promptly Filled.

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"Pittsburgh's Radio Shop"

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**"IDEAL" C W APPARATUS**



## Radio Frequency Transformers

Type RT-1, for the amateur and broad-casting range, 175-500 meters.  
(Patent Pending)

**\$6.00**

Will work on all tubes.  
The only completely shielded iron-core  
R. F. Transformer

**RADIO SERVICE LABORATORIES, Inc.**  
ASBURY PARK, NEW JERSEY





# New "Read 'Em" Binding Posts

16 Styles

Antenna

Ground

Condenser

Tickler

Variable Condenser

A—Battery—

A—Battery +

B—Battery—

B—Battery +

Plate

Detector

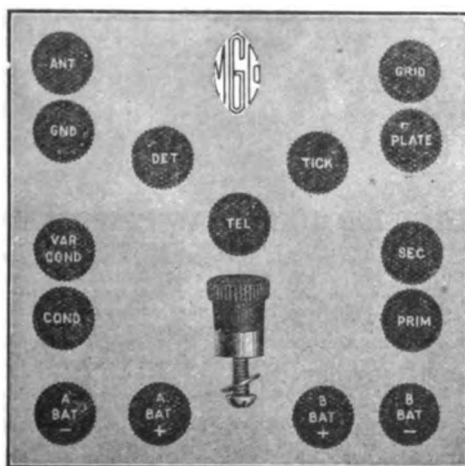
Phonea

Secondary

Primary

Grid

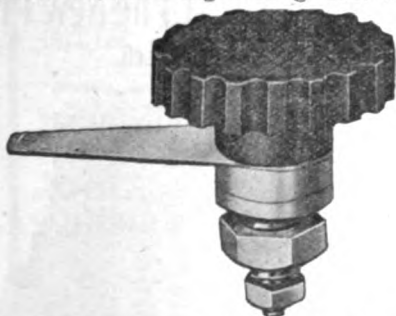
Filament



Complete Post and Knob 15c each

The enormous demand for these "read 'Em" binding posts, prompted us to put in a large stock to take care of our friends. Our stock is complete.

We are in equally fine position to fill orders promptly for binding posts made up of exactly the same high grade material and workmanship—the same in every way, without the knob engraved @ 12c. each.



SWITCH ARM TYPE S. A. 3

Price .....\$ .50 Each

Knob—1 1/4" Knurled Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 1—Price.....\$ .40 Each

Same as above with 1" radius knob.



SWITCH ARM TYPE S. A. 4

Price .....\$ .50 Each

Knob—1 1/4" Fluted Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 2—Price.....\$ .40 Each

Same as above with 1" radius knob.

Send Us Your Orders Now

Orders will be shipped the day they are received. Send in your order early.

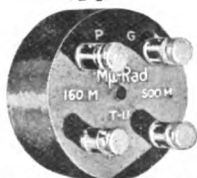
## THE KUEBLER RADIO COMPANY

124 St. Clair Street

Toledo, Ohio

# Mu-Rad RADIO Laboratories

**R. F. TRANSFORMERS**  
Types T-11, T-11a, T-11b



**WAVELENGTH RANGE**  
160-500 meters

## RADIO FREQUENCY AMPLIFICATION

Introducing two new MU-RAD R.F. amplifier transformers Type T-11a and T-11b. We have again anticipated the entire field in multi-stage R.F. amplifier design. Users already know the fine results obtained by using two or three MU-RAD T-11 transformers for 2 or 3 stage amplification; but we have developed and protected our rights in a method for obtaining still greater amplification. The load in the plate circuit of a vacuum tube is reflected into the grid circuit thru the grid-plate capacity, and maximum amplification for more than one stage can therefore only be obtained by proper recognition of this fact in its influence upon the design of the transformers in each stage. Other manufacturers use the same transformers in every stage. MU-RAD uses different transformers for SUPER-AMPLIFICATION.

For one stage amplification, use Type T-11 between amplifier tube and detector. (Usually equivalent to two stages with other transformers.)

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For Three stage amplification, use Type T-11b between first and second amplifier tubes, Type T-11a between second and third amplifier tubes, and Type T-11 between third amplifier tube and detector. DEALERS: Write.

R.F. Amplifier transformer Type T-11 .....\$6.00

R.F. Amplifier transformer Type T-11a..... 6.50

R.F. Amplifier transformer Type T-11b..... 7.00

**MU-RAD LABORATORIES, Asbury Park, New Jersey; St. Louis, Mo.**  
**THE BENWOOD COMPANY, Inc., ST. LOUIS, MO.** Distributors west of Mississippi River.

## Ask Sorsinc

The highly professional service which our seasoned radio men give—backed by complete stocks of the leading lines of equipment make it well worth your while to ask



before buying. We know from experience what each piece of apparatus will do.

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## SHIP OWNERS' RADIO SERVICE INC.

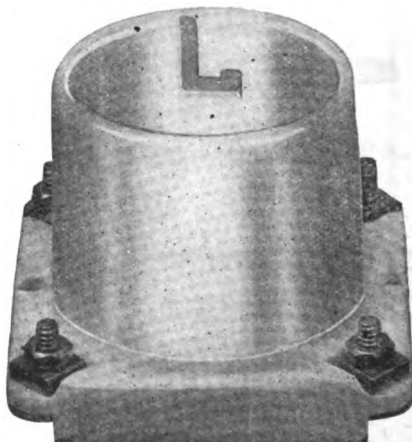
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Branch Offices and Dealers Everywhere  
**"THE LARGEST RADIO CHAIN STORE SYSTEM IN THE WORLD"**

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Herewith 6 cents in stamps to pay mailing expense on my copy of your latest booklet.

Q-4-2

## The Original - At The New Price

50 cents each



The original socket with the concealed bayonet slot.

The old adage: "Imitation is the sincerest form of flattery" still holds!

Ask Your Dealer or Write Direct to:

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—instead of—  
—getting all we can for what we give."



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could well be called the world's greatest known press-agent. With much pomp and ceremony he is received everywhere.

Your order received, "pomp" becomes "prompt" and the ceremony consists of the service we render our customers.

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| No. CR-5 Grebe super-special 175-3000 meters with detector complete.....  | 80.00   |
| No. CR-8 Grebe 175-1000 meters with detector latest type short wave set. 80.00                                  |         |
| No. CR-9 Grebe 175-3000 meters complete with det. & 2 stage amplifier. 130.00                                   |         |
| No. CR-6 Grebe 175-680 meters with det. and 2 stage amp. phone & series cond. ....                              | 200.00  |
| No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet .....                                     | 68.00   |
| No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, complete ..... | 130.00  |

| KENNEDY EQUIPMENT            |          |
|------------------------------|----------|
| Type 110 Universal .....     | \$250.00 |
| Type 2201 Intermediate ..... | 125.00   |
| Type 281 Short Wave .....    | 80.00    |
| Type 525 Amplifier .....     | 85.00    |
| Type 521 Amplifier .....     | 55.00    |

| RECEIVING SETS (Crystal)  |         |
|---|---------|
| "Aerila Jr.," Westinghouse, complete with Brandes "Superior" phones ..... | \$25.00 |
| "Radiola" DeForest, complete with Brandes "Superior" phones .....         | 25.00   |

| VACUUM TUBES                         |        |
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| No. UV-201 Radiotron amplifier ..... | 6.50   |
| No. UV-202 Radiotron 5 watt .....    | 8.00   |
| No. UV-203 Radiotron 50 watt .....   | 30.00  |
| No. UV-204 Radiotron 250 watt .....  | 110.00 |

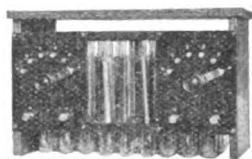
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**SEND YOUR ORDER**  
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Please include sufficient postage with all mail orders



# Storage Batteries

Designed Especially For

# WIRELESS

*"Cheapest in the long run"*



## KICO "B" BATTERIES

KICO storage "B" batteries will end your "B" battery troubles. YEARS of Real service, saving you money in the end. One charge lasts from three to six months while in your detector plate circuit. Short-circuiting, overcharging or standing **DOES THEM NO HARM.** Durablely constructed of the best materials and highly finished making a piece of apparatus which will fit in any station. Can be charged from your A.C. line in one hour after the first charge which takes about four hours. All batteries are supplied with chemicals, rectifiers and directions for setting up. One quart of distilled water puts your battery into service. Money back if unsatisfied within three months trial. Prices as follows

|                | Plain  | With Panels |
|----------------|--------|-------------|
| 24 cells 32 V. | \$4.00 | \$11.00     |
| 36 cells 48 V. | 10.00  | 13.00       |
| 50 cells 66 V. | 12.00  | 16.00       |

## KICO "A" BATTERIES

No more ACID EATEN rugs or furniture. Truly a PARLOR battery, designed especially for wireless den, yet sturdy enough to kick over starter on Ford, Chevrolet or any car taking a battery 9"x7". Box and jars moulded in one piece from ACID-PROOF composition much tougher than hard rubber. A Box that will NOT crack, break or leak in battery use. 6 volt 80 to 100 A.H. capacity, guaranteed for 18 months but will last for years if used only for wireless @ \$24.00

We also manufacture the following sizes designed especially for C.W. work, assembled in especially treated, durable hard wood boxes with hard rubber jars and covers with deep sealing space, sealed with great care to prevent leakage. Guaranteed 18 months.

|                     |         |
|---------------------|---------|
| 6 volt 80-100 A.H.  | \$20.50 |
| 8 volt 80-100 A.H.  | 27.00   |
| 10 volt 80-100 A.H. | 33.00   |

Batteries shipped fully charged ready for use with hydrometer and full instruction for upkeep. Special sizes built to your specifications.

*Circulars furnished upon request.*

**KIMLEY ELECTRIC CO., 290 Winslow Ave., Buffalo, N. Y.**

# For REAL Service

Mail your orders to us. We can supply you with the BEST at the BEST PRICES. Shipments made within 24 hours after receipt of order.

CATALOGUE  
#22  
AT YOUR  
SERVICE

## THE SERVICE RADIO EQUIPMENT CO.

Designers—Manufacturers—Distributors

225 SUPERIOR ST.,

TOLEDO, OHIO



Dial No. 23

# THE QUALITY DIAL

Diameter 3"

Made for 3/16" and 1/4" Shafts.

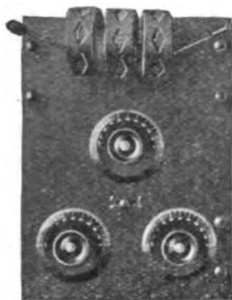
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# Type "Q" Receiver



## AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....\$35.00

## Duck's New Radio Catalog No. 16



Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.

### 275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many text books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

## The William B. Duck Company

243-245 Superior Street

Toledo, Ohio



Type TAW, Flush Model

# A New Bulletin

## ON SMALL RADIO INSTRUMENTS

is now ready. It covers not only our line of three and onehalf inch **thermal** instruments, but also our lines of A.C. and D.C. instruments in the same size cases. All ranges required in modern radio work are included. You will be interested in this Bulletin which gives full details. In writing us mention Bulletin No. AG-10. **IT IS FREE!**

**ROLLER-SMITH INSTRUMENTS ARE SOLD BY ALL GOOD DEALERS**

**ROLLER-SMITH COMPANY**  
Electrical Instruments Meters and Circuit Breakers

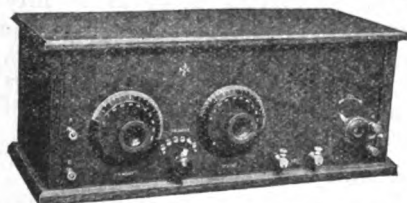


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ACE "ACE RADIO CONCERT RECEPTOR" ACE



Type TRU Concert Receptor \$50.00

(Licensed under Armstrong Patent 1,113,149)  
This unit is especially designed for the efficient reception of Radio Telephone Concerts from even the most distant Broadcasting Stations. The ease with which this Receptor can be installed and the extreme simplicity of operation make it ideal for use by even the most in-experienced. No previous knowledge of radio necessary to secure results.

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with

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A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

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# Signal Service To Radio Electricians

Signal Radio Apparatus is *built complete* in Signal shops from designs developed in the Signal Laboratory by Signal Radio Engineers.

Before you spend a dollar on Radio equipment, check up the *Signal Line* against the field and the first step is to secure all Signal Literature. It's free—write today.

Write today for latest literature and name of nearest dealer.

**Signal Electric Manufacturing Company**  
**Menominee, Michigan**

# EBY BINDING POSTS AGAIN MADE A TREMENDOUS HIT AT THE NEW YORK RADIO SHOW



Corporal  
(Brass—13c)  
with stud & nut



Sergeant  
(Brass—20c)  
with  
screw & washer

Our 4 latest posts (BUDDY, SERGEANT, JUNIOR and JUNIOR H) sure won the hearty approval of every manufacturer, dealer and amateur who saw them at the SHOW.

The 4 posts shown are especially suitable for RADIO use and our increased facilities enable us to NOW MAKE PROMPT DELIVERIES.

LEADING MANUFACTURERS have adopted our posts and DEALERS everywhere are carrying an attractive stock.

To the AMATEUR who is building his own, here's your chance to equip your set with THE BEST BINDING POST ON THE MARKET. Ask your dealer to show you THE EBY LINE.

EBY POSTS SERVE, SAVE AND SATISFY



Junior—15c  
(including nut)



Ensign H—20c

**THE H. H. EBY MANUFACTURING CO., 605 ARCH ST., PHILADELPHIA, PA.**

## DEALERS AND RADIO CITIZENS

Order Your Needs From Our

**LARGE AND COMPLETE ASSORTED STOCK**

**PARTS OF ALL KINDS**

**COMPLETE SETS**

**LARGEST STOCK RADIOTRONS AND KENOTRONS IN U. S. A.**

**ALL TUBES SHIPPED PREPAID**



*Write for our new price list No. 100-T*

**LUDWIG HOMMEL & CO.**

**530-534 Fernando St.,  
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# "DEL FELCO"

**DELANCEY FELCH & CO.**  
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## Radio Special Storage Batteries

|                     |         |
|---------------------|---------|
| 4 Volt, 60 Amp..... | \$10.00 |
| 6 Volt, 40 Amp..... | 12.00   |
| 6 Volt, 60 Amp..... | 14.00   |
| 8 Volt, 60 Amp..... | 18.00   |

Fully Charged. F.O.B. Boston. No Charge  
For Crating.

Guaranteed for One Year  
Manufactured by

**W. & G. TUFTS**

**336 Newbury St.,**

**Boston, Mass.**



# Read what Godley says

Radio Corporation of America  
233 Broadway  
New York City,

As the representative of the American Radio Relay League in England during the recent Trans-Atlantic Amateur Transmission Tests, I wish to call your attention to the assistance given by all members of your organization from whom assistance was asked, and the cheerful, wholehearted manner in which it was given.

I have endeavored, both in the written accounts of my experiences as well as in verbal reports of it, to point out the great value of this assistance, and to call attention to the fact that Radio Corporation Detector Tubes Type **UV 200** were used during the reception at Ardrossan in conjunction with the regenerative receiver and 2-stage tone, frequency amplifier. These tubes functioned admirably, and the results obtainable was a surprise to the several British amateurs who saw them in operation.

All Radio Relay men with whom I have spoken concerning the matter since my return are deeply grateful for the co-operation given by your company, and fully appreciate that the completeness of the success of the ventures would have been lacking in great degree but for your co-operation.

Respectfully,

*Paul F. Godley*



It was a great triumph for the amateurs when they sent messages across the Atlantic to Scotland. But it was also a Radiotron triumph. Read what Paul F. Godley says in the letter here reproduced in facsimile.

There are two Radiotrons available for reception. For Detection — Radiotron UV — 200, the popular tube used by thou-

sands of amateurs and novices because of its long life and super-sensitiveness. Price \$5.

For Amplification — Radiotron UV — 201, the amplifier tube which gives maximum amplification without distortion and which, like UV — 200, is used throughout the nation for radiophone broadcasting reception. Price \$6.50.

*Ask your nearest Dealer for Radiotrons*

**Radio**  **Corporation**  
*of America*  
Sales Department, Suite 1803  
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# RHAMSTINE\*

PRODUCED THE

## ADAPT-O-PHONE

FOR A LISTENING WORLD

Developed from a special study of the requirements of a Radio Age, the Rhamstine\* Adapt-O-Phone brings added satisfaction to your hours "listening in."

Scientifically designed and balanced so that the sounds from your two receivers are clearly and correctly amplified. The Adapt-O-Phone is twenty inches high, attractively finished and reasonably priced.

**Price \$12**

without receivers  
Add 25c for Postage and Packing;  
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\*Maker of Radio Products

## Keep Your Battery Fully Charged

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## Riggs Rectifier

The simplest, lowest priced and most efficient RECTIFIER on the market. Has only ONE adjustment and is absolutely fool proof.

No amateur wireless outfit, or up to date private garage is complete without this RECTIFIER, by means of which your wireless, or automobile battery is kept fully charged.

Sent parcels post East of the Rocky Mountains upon receipt of price,

**\$12.50**

Your money back, if you are not  
FULLY SATISFIED

**THE RIGGS MFG. CO.**  
**URBANA, OHIO**

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## When you think of Radio think of JONES

I am located in my new store and carry a large stock of all standard makes of sets and parts.

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Holtzer-Cabot  
2200 ohms .....\$8.00  
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2200 ohms ..... 8.00  
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2200 ohms ..... 8.00  
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General Radio  
#247A ..... 5.50

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Electron Relay .. 5.00

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Radiotron UV 201..\$6.50  
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Parts for making your own Regenerative  
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Bakelite Variometer wound.....\$8.00  
Bakelite Bank-wound inductance..... 4.50  
Switch arm—double arm..... .75

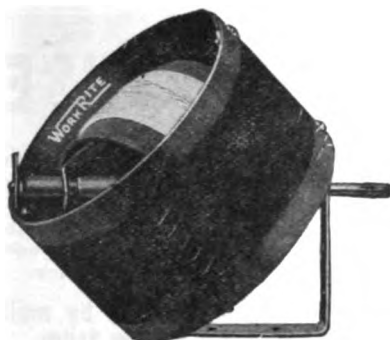
Also a complete line of small parts.

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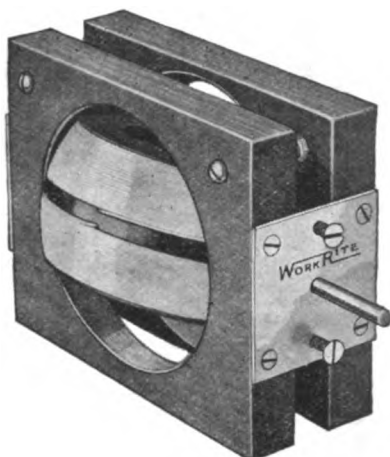
Radio Apparatus

94 Massachusetts Ave., Boston, Mass.

# "WORKRITE PRODUCTS WORKRITE"



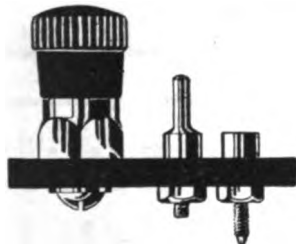
Finest  
Material  
Finest  
Workmanship  
Finest  
Finish



Here is the "Tuner Team" that radio fans have been going wild over wherever shown. Most dealers have their entire allotment sold before shipment is received. "They certainly do WorkRite" is the verdict of all users.

One WorkRite Variocoupler and two WorkRite Variometers are guaranteed to give you a tuner that cannot be excelled by anything on the market.

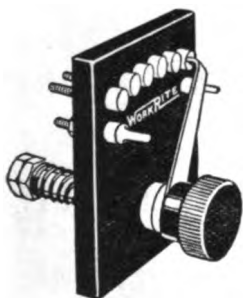
## WORKRITE VARIOCOUPLER OR VARIOMETER IN ATTRACTIVE BOXES \$6.00 EACH



WorkRite Binding Posts.....\$0.12

WorkRite Switch Points......04

WorkRite Switch Stops......06



Just what you want.  
Remove the parts and  
use the block as a  
template for drilling  
your panel. Put up in  
neat individual boxes.  
Complete WorkRite  
Switch Sets, \$1.00.  
Switch arm only, with  
bushing, 50c.

## TYPE "A" WORKRITE HYDROMETER

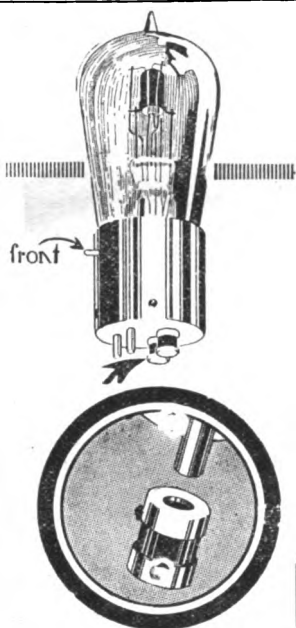
Double the life of your battery  
by giving it proper care. Fill  
and test it regularly with a  
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let it become discharged below  
1150, or it will soon be ruined.  
Full instructions for testing  
and care of battery with each  
"WORKRITE." Get one now!  
Price, \$1.00



Insist that your dealer furnish a "WORKRITE." Accept no substitute.  
If he cannot supply you, we will ship direct by mail prepaid.

**JOBBER AND DEALERS—Write or Wire for Discounts**

**The WORKRITE Mfg. Co.,** 5603 Euclid Ave.  
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## You Need Never "Burn Out" a Tube!

At few cents cost you can have absolute protection of your Vacuum Tubes with the new

# RADECO SAFETY FUSE

(Patent pending)

Placed where every bit of juice must go through it before reaching the filament, this tiny fuse makes it absolutely impossible for any excessive amperage, even if

from accidental "short", to burn out a filament. Fuse links directly on filament terminals of any standard bulb in any standard socket and does not affect efficiency.

Come only in Packages of four

## 4 for \$1

Order by mail or from your dealer

Carrying capacity 1-2, 3-4, 1, 1 1-2, 2, 2 1-2, and 3 amperes.

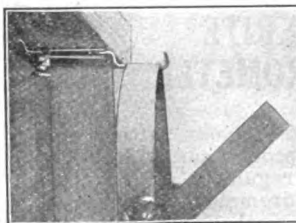
## DEALERS!

Order this "live" one while we have stock on hand for quick delivery. Write today for dealer's prices.

**RADIO EQUIPMENT CO.,** 630 Wash'n St., Boston, Mass.  
New England's Oldest Exclusive Radio Store

## "UNIVERSAL"

### Introducing the Radio Hookswitch



"Gee-whiz

I FORGOT TO  
TURN OFF MY  
TUBES

Good night  
Battery!"

How many times, Brother Amateur, have you spoken the above words? But you will forget no more—NO, you will

Pat. Applied for not even have to remember. We have solved the problem for you, and besides have found the most convenient and inconspicuous place for your 'phones; on a hook under the edge of the table. The Universal 'Radio Hookswitch' simultaneously acts as a phone hook and a vacuum tube switch. More than one may be connected in parallel. Complete with screws and lug.

**NICKEL PLATED \$1.25 prepaid**  
**GOOD PROPOSITION TO DEALERS**

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**KEEP THE PHONES OFF THE TABLE**

## The Sixth Edition Is Ready!

It includes all the

**LATEST PRICES  
ON EVERYTHING**

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FOR YOUR FREE COPY  
of this**

**INDISPENSABLE  
PRICE DICTIONARY**

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**OPERATING KINEMA THEATER  
RADIOPHONE**

Call KOG—Los Angeles

# Better Results and Longer Life from Your Tubes



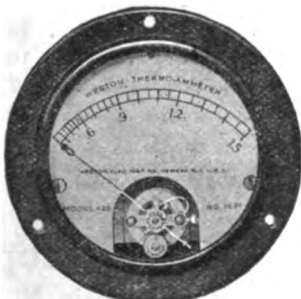
**Filament Voltmeter**



**Filament Ammeter**



**Plate Voltmeter**



**Antennae Ammeter**

Every make of tube should be operated at some specific voltage.

Tubes function best within extremely narrow limits. Unless you operate within these limits it is impossible to obtain the best results, and tube replacement expense runs up rapidly. It is foolish to regulate your tubes by the degree of illumination of the filament.

In the early days of power plants, operating engineers attempted to maintain voltage by the brilliance of a pilot lamp. Today, *such a practice is absolutely unheard of*. Voltage is established and maintained by means of accurate and reliable voltmeters.

In the very near future of radio, the filament voltmeter will be regarded as absolutely indispensable.

Will you follow the wise practice of voltmeter filament control *now*, or will you wait until bitter experience convinces you of your error?

Our Circular "J" describes in detail Weston Filament Voltmeters and other important instruments invaluable to owners of up-to-date receiving and transmitting sets. Send for a copy without delay, if your dealer cannot supply you.

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Branches in all the Principal Cities



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RADIO**

**INSTITUTE**

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REMEMBER:—Our ORGANIZATION with YEARS OF PHENOMENAL EXPERIENCE and SUCCESS is behind EVERY man who enrolls!

"Ask any man in Radio—he will tell you!"

Our illustrated prospectus for the asking.

F. D. PITTS, Director.

— i t ' s   h e r e

**THE HI-GEE**

**C.W. AND PHONE RECEIVER**

This set is unexcelled for C.W. work and the reception of musical concerts.

**SPECIFICATIONS**—The Hi-Gee receiver comes to you completely assembled but unwired, in a quartered oak cabinet with hinged cover. All controls are mounted on a formica panel 7x12, and all connections are made to clips attached to sub-panel within the cabinet. Condenser and rheostat are controlled by special vernier attachments. **THE ONLY RECEIVER** on the market with these specifications.

Moderately priced at .....\$25.00

With the first 25 receivers sold from this ad we will supply absolutely free a Radiotron detector tube, and a Hi-Gee "B" battery.

Get your order in now for immediate delivery. This is one of the greatest bargains of the year.

**OTHER SPECIALS**

Improved HI-GEE Variometers .....\$4.00

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HI-GEE "A" BATTERIES, 2 year guar-

antee, 6-60 .....12.95

6-80 to 100, \$20.95. HI-GEE "B" Batteries

\$0.90, tapped \$1.10, best grade, plain \$1.20.

All shipments prepaid except storage batteries

Get Our New Bulletins

**Hi-Gee Radio Manufacturing Co.**

**MARION**

**ILLINOIS**

116

## CLARION "A" BATTERIES

Type R-2 6V-60A.H. ....\$20.00

Type R-3 6V-80A.H. .... 25.00

This is the finest finished battery you can buy. It is guaranteed for two years. Here are some of its special features; solid oak case, wax finished, polished top, acid proof terminals (real binding posts) special designed cell tops, acid cannot reach the outside of case.

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6-40 Special .....\$8.00

6-80 Special .....16.00

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6-80 Type H.V. ....20.00

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We carry in stock a complete line of Radio Supplies. Send for Bulletin.

**Clarion Radio Shop**

347 Main St., Poughkeepsie, N. Y.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# Quality



# Service

## DISTRIBUTORS OF LEADING MAKES OF RADIO GOODS GOOD GOODS—GOOD STOCK—GOOD SERVICE

No. UV-200 Radiotron Detector ..\$5.00  
 No. UV-201 Radiotron Amplifier . 6.50  
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 No. PR-535 Filament Rheostat .... 3.00  
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 UV-203 & 204 Tubes .....10.00  
 No. PX-1638 Grid Chopper ..... 7.25  
 No. UP-1638 325 w. Transformer 25.00  
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 No. UC-1631 Filter Condenser .. 1.35  
 No. UC-1632 Filter Condenser .. 1.85

We have the above and all other Ra-  
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 NEW General Electric Tuner Type  
 AR-1300 .....50.00

New General Electric Amplifier  
 Type AA-1400, 1 Stage Radio  
 Amplification, Audio Detector,  
 1 Stage Audio Amplification ..\$75.00

New UV-1714 Radio Frequency  
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Moorhead ER Detectors ..... 5.00  
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 Clapp-Eastham HR Receiver ....\$40.00  
 Clapp-Eastham HZ 2 Stage  
 Amplifier ..... 40.00

The above is a wonderful set and has  
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 Receiver is complete and will receive  
 phone without the amplifier. HR and  
 HZ are now furnished in mahogany cab-  
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C.E. Maximus Amp. Transformer \$4.50

This is new and very efficient. We  
 have a complete stock of all other CE  
 apparatus.

All Sizes of "B" Batteries  
 Weco Moulded Socket .....\$0.75  
 Large Hard Rubber Binding Posts .12  
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Complete line Remler Goods, Signal  
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Distributors of ACE Batteries.

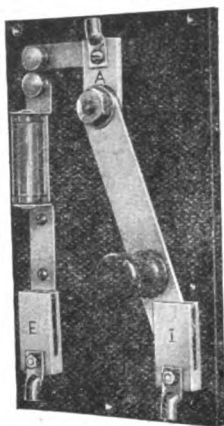
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# THE HORNE Radio Appliances

Particularly

## Lightning Arresters AND Grounding Devices

COMBINED  
SWITCH AND  
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Lightning Arresters  
Combined Switches  
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We make everything in  
Radio Except Head  
Phones and Tubes  
10c. brings complete  
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The Horne "Drive" Hydroground

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V-T Vacuum Tube Sockets  
Variable Condensers  
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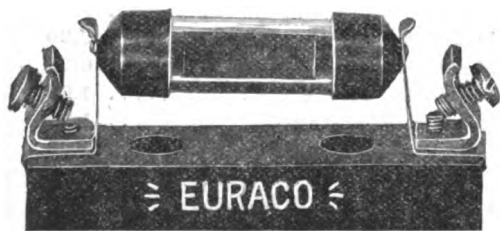
THE HORNE MFG. CO.,

243 Mercer St., Jersey City, N. J.

## "Euraco" Mica Condenser

PRICE 60 CENTS

Designed to Fit Standard Grid Leak Base



Composed of Copper and Mica, Entirely Hand Made.

Compact, Interchangeable, Most Efficient

Following Capacities in Stock:

.00025 Mfd.—Correct for Super Heterodyne  
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.0001 Mfd.—For special and experimental  
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.000025 Mfd.—Correct for Radio-Audion  
RAC-3 valve.

.0005 Mfd.—Correct for Radiotron UV-200

Condenser Mountings:

Bakelite Base with Single Mounting..\$0.40

Bakelite Base with Double Mounting.. .60

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Interesting Proposition for Dealers

EUROPEAN RADIO CO.

Mfrs. of Multi-Stage Amplifiers, C.W. & Special  
Equipment

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We offer for the first time a special

## CORRESPONDENCE COURSE in CITIZEN RADIO

giving complete non-technical instruction in  
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amateurs need to know.

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The surplus of experienced commercial  
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again in position to guarantee positions  
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VACUUM TUBE

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|----------------------|----------------------|----------------------|
| SERIES               | TRANSMIT             | RECEIVE              |
| 3 <sup>RD</sup> STEP | 2 <sup>ND</sup> STEP | 1 <sup>ST</sup> STEP |
| TICKLER              | GRID VARIOMETER      | PLATE VARIOMETER     |
| SECONDARY CONDENSER  | B BATTERY - +        | A BATTERY - +        |
| OUTPUT               | INPUT                | PRIMARY CONDENSER    |
| TELEPHONE            | PARALLEL             | DETECTOR TUBE        |
| + -                  | COUPLING             |                      |

### A COLOSSAL EVENT THE "RASCO" CATALOG

There are many radio catalogs, but the "Rasco" catalog marks a radical change for the simple reason that it

#### Contains 50 Vacuum Tube Hook-Ups

This is the one and only radio catalog containing such wonderful free information. Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector; detector and one-step amplifier; regenerative circuit; DeForest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; C.W. transmitters; self-rectifying 2 tube C.W. transmitter; V.T. transmitter with 6 volt battery; radiophone using plate and grid modulation; one tube radio transmitter and receiver; experimental radiophone; radiophone using Colpitts oscillator circuit.

The catalog contains 185 illustrations. On account of its great cost, this catalog cannot be distributed free of Charge. It will only be mailed upon receipt of 15c IN STAMPS OR COIN

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### "RASCO" AUDIO FREQUENCY TRANSFORMER

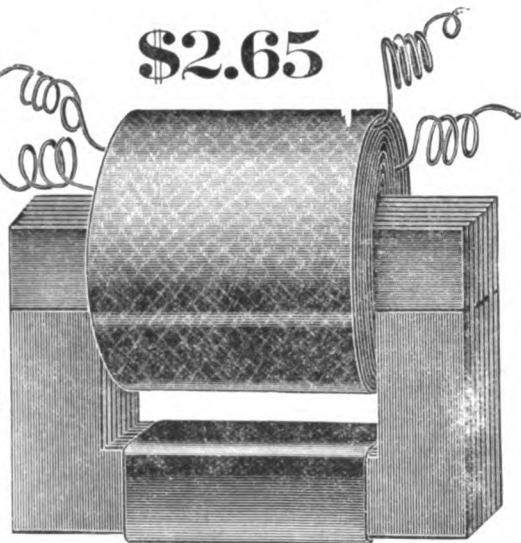
This transformer has been developed by us after comparing all the various transformers on the market. This transformer is guaranteed to equal any on the market today. The primary and secondary are very carefully built and are impregnated with a certain wax in vacuum. The stampings are of the best silicon steel. Only the very best material is used throughout.

Realizing the fact that most amateurs desire to "make their own" we furnish this transformer unassembled. Directions which accompany the transformer are such that anyone can put the parts together in about ten to twelve minutes. This saves you considerable money, for the reason that manufacturers who assemble the transformers must charge you for the assembling work.

Illustration as shown is in full size. The weight complete is ten and one-half ounces. Note also that we ship all goods prepaid. We pay the freight.

No. 1100 "Rasco" Audio Frequency Transformer NOT ASSEMBLED, prepaid

**\$2.65**



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Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. A trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

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# MAGNAVOX

---world's standard loud speaker



*The  
reproducer  
with the  
movable coil*

No set is complete without a Radio MAGNAVOX. It is the one piece of apparatus known to radio which will faithfully reproduce *either* radio signals, radio music or radio telephone speech in *any* volume without distortion. There is NO substitute for the Radio MAGNAVOX. No extras or adjustments required. Simply sit back, listen, entertain, and enjoy. Where power amplification is desired, use a new two or three-stage MAGNAVOX Power Amplifier. Ask your dealer for a demonstration.

THE MAGNAVOX CO., Gen. Office, OAKLAND, CAL.

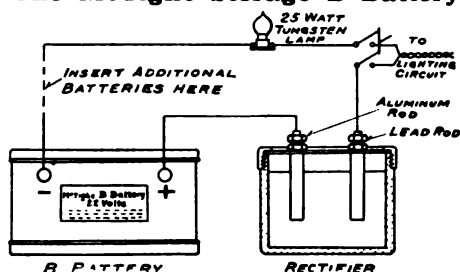
NEW YORK OFFICE, 370 7th Ave., Penn Terminal Bld.

*In writing please address the MAGNAVOX office nearest you.*

Type R-3 Radio MAGNAVOX, as illustrated, with 14" horn, beautiful and durable as it is efficient. There is NO substitute for the Radio MAGNAVOX. Any one can operate it, every one can enjoy it. Only one ampere necessary to energize the field. The few simple instructions necessary, free with each outfit. Price—\$45. Buy from your dealer.

**NO set complete without a MAGNAVOX**

## The McTighe Storage B Battery



## The McTighe Storage B Battery

is of alkaline type and is practically indestructible. Its capacity is ample for a several stage amplifier and a one hour charge will last for several weeks in ordinary service. No injury is caused by accidental short circuit or by standing idle.

The Battery is contained in an attractive case. Cells are held rigidly in place, and tight fitting cover prevents evaporation.

As many as four units in series can be charged from one rectifier on 110 volt A.C. lighting circuit.

Write for descriptive leaflet, or better, order a Battery and rectifier today.

Dealers:—The McTighe B Battery has no shelf depreciation.

Battery .....\$4.00  
Rectifier ..... 1.50

Add Postage.

**ECONOMIC APPLIANCE COMPANY**

Successor to

**McTIGHE BATTERY COMPANY**  
Irwin, Pa.



**New Catalog E6 FREE**  
Just off the press

Keep up-to-date. Learn about all the big recent improvements in radio apparatus.

84 pages chuck full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything.

### Two N-S LEADERS

Red-Head Radio phones, 3000 ohms, military head band with cord complete Per pair \$8.00  
Arlington Tested Crystals; Galena or Silicon. Certified super-sensitive Percrystal 25c.

Write for Big Free Catalog Today

**THE NEWMAN - STERN CO.**  
Newman--Stern Bldg., Cleveland, Ohio

### WARNING

Do not discard your spark sets. They will prove invaluable later on.

If you want to make your present spark set approach a C.W. set for results:

Write to

**ROY C. BURR**

19515 Tiverton Rd., Cleveland, O.

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LOWEST

# P.

POWER

# F.

FACTOR

## G.A. Standardized Instrument Panels

**L. P. F.** should be your choice for all instrument panels not only because of its freedom from losses at high frequencies but because of its mechanical advantages.

Bureau of Standards tests show that it has the Lowest Power Factor of any sheet insulation, 0.7% against 3.5% for the best substitute material, and these tests were made at the low wavelengths at which losses are most marked.

In appearance L. P. F. has polished jet black surfaces which take a handsome grain finish and do not turn grey. In dimensions L. P. F. panels are accurate to  $\frac{1}{8}$  in., with true right angle corners, smoothly cut. You can drill, tap, file and cut L. P. F. more easily than other panels. You can throw them across the room but they will not chip or crack. You can subject them to the severest tests and L. P. F. panels will come out on top every single time.

Moreover, in buying L. P. F. you get its electrical and mechanical advantages at a lower price than is charged for inferior substitutes. You can get these panels from your local dealer or directly from the G. A. Company. And remember that every panel carries a yellow label bearing the name "L. P. F." and the G. A. trade mark. A panel which does not bear this label is not L. P. F.

| Length  | Width                | Thickness         | Weight               | Price  |
|---------|----------------------|-------------------|----------------------|--------|
| 5 ins.  | 2 $\frac{1}{2}$ ins. | $\frac{1}{8}$ in. | 3 oz.                | \$0.33 |
| 5 ins.  | 5 ins.               | $\frac{1}{8}$ in. | 6 oz.                | .66    |
| 10 ins. | 5 ins.               | $\frac{1}{8}$ in. | 12 oz.               | 1.31   |
| 10 ins. | 10 ins.              | $\frac{1}{8}$ in. | 1 $\frac{1}{2}$ lbs. | 2.62   |
| 15 ins. | 10 ins.              | $\frac{1}{8}$ in. | 2 $\frac{1}{2}$ lbs. | 3.93   |
| 5 ins.  | 7 $\frac{1}{2}$ ins. | $\frac{1}{8}$ in. | $\frac{1}{2}$ lb.    | .99    |
| 10 ins. | 7 $\frac{1}{2}$ ins. | $\frac{1}{8}$ in. | 1 lb.                | 1.97   |
| 15 ins. | 7 $\frac{1}{2}$ ins. | $\frac{1}{8}$ in. | 1 $\frac{1}{2}$ lbs. | 2.97   |
| 20 ins. | 7 $\frac{1}{2}$ ins. | $\frac{1}{8}$ in. | 2 lbs.               | 3.74   |
| 5 ins.  | 2 $\frac{1}{2}$ ins. | $\frac{1}{4}$ in. | 2 oz.                | .24    |
| 10 ins. | 2 $\frac{1}{2}$ ins. | $\frac{1}{4}$ in. | 4 oz.                | .45    |

If it doesn't bear the yellow label, it isn't L. P. F.

## RADIO and MODEL ENGINEERING

Did you see the article in the December R and M on a rectifying unit for undamped wave telegraph and telephone transmitters, or the one on tuned plate receiver for 150 to 600 meters? Better send for that issue before it's too late. And you want the dope on radio telephone receiving sets in the January number. There were also some handy ideas that will take the kinks out of your shop work too.

When you send in for these back issues put in a dollar extra for a year's subscription to start in with February. R and M gives you the best in strictly practical, construction articles.

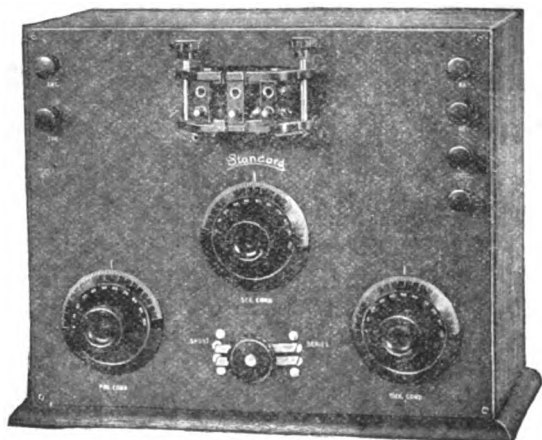
BACK COPIES PREVIOUS TO DECEMBER 1921 ARE NOT AVAILABLE

**The General  
Apparatus Co., Inc.**

**88 PARK PLACE, NEW YORK**

Represented in every city of the United States and Canada where radio work is done. Send 10c. in stamps for the new G. A. catalog.

## THE STANDARD PLAN—"ASSEMBLED BUT NOT WIRED"



MULTIPLE WAVE TUNER

*This tuner will be shipped anywhere in the United States upon receipt of one third the purchase price. Examine the instrument carefully and if acceptable, remit the balance. If you are not perfectly satisfied, simply return the instrument and we will refund your deposit. If you do not wish to order at once, send a stamped return envelope for our literature describing the complete line of Standard instruments.*

**STANDARD ASSEMBLING CO. 91 BRIDGE ST., N. Y. C.**

## NOISELESS DEPENDABLE GUARANTEED



### "B" Batteries for Vacuum Tubes

22½ to 100 Volts

19 Different Sizes—Plain and Variable

**NOVO MANUFACTURING CO.**

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NEW YORK CHICAGO

## TIN FOIL

(Special)

For Condensers and Lining Panels—24 sheets per lb. Size Sheet—6" x 12".

40c lb. Full Instructions Add Postage.

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620-46th St. Brooklyn, N. Y.

## Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

### SPECIAL!

|                                 |        |
|---------------------------------|--------|
| Vacuum Tube Sockets.....        | \$1.25 |
| Rheostats .....                 | 1.25   |
| 22½ Volt "B" Batteries.....     | 1.50   |
| Rasco Dials .....               | .60    |
| Rubber Binding Posts.....       | .20    |
| Tested Galena .....             | .40    |
| Latera! Wound Coils. All Sizes. |        |

SEND 5c FOR OUR NEW PRICE LIST

**J. M. PAQUIN,**

THE ELECTRICAL SHOP

787 Queen St. West, Toronto, Ont.

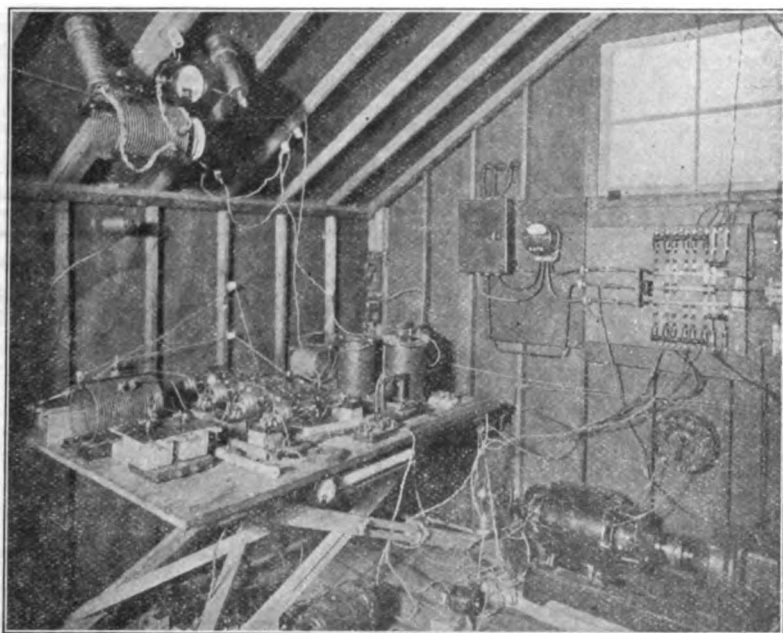
### FIVE \* SEE \* EYE

I specialize on CW transmitting and receiving equipment. QRN's coming on—so get that CW set **gg** and get thru.  
Thordarson CW transformers—for 5 watts.....\$7.50  
Clapp-Eastham type HR Short Wave sets.....\$35.00  
Thor. Amplifying Transformers—Burgess Batteries—  
—FADA rheostats—Paragon sockets—Arkay Radio-horns—tubes—etc.—Glad to answer all inquiries—  
write—

FIVE \* SEE \* EYE—FROST, TEXAS,  
(In Central Texas) M. B. Patterson, Mgr.

# Dubilier Condensers Helped to Make Radio History

"No circuit is stronger than its weakest link." When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



Are your condensers the weakest link in your circuit? There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.

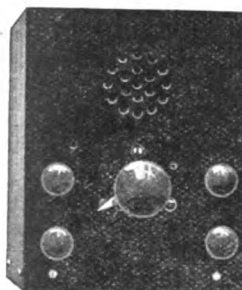
## **Pacent Electric Company, Inc.**

150 Nassau Street,

New York City

Member Radio Section Associated Manufacturers of Electrical Supplies.

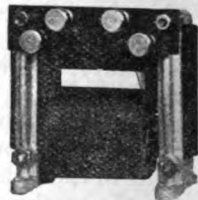
# QUALITY AMPLIFIER UNIT



Entirely complete ready to operate.  
Parts cost as much as the finished ultra efficient high power amplifier.  
Unequaled for loud speaker work with regular or power tubes.

Gives wonderful results with power tubes using high voltage without danger of burning out windings.  
Use as many stages as you like.  
Fully shielded with aluminum grounding plates eliminating howling.

Quality square coil 10-1 ratio transformer, is the best produced today combined with Bakelite ratchet and rheostat, Eby clamping binding posts, Bus bar wiring an unusual special circuit and beautiful workmanship to produce this remarkable instrument gives clearest, strongest signals you ever heard.



## \$12.50 Immediate Delivery

Quality Hi-Power Amplifying Trans. The Trans. with the square coil and without air gap 10-1 ratio.

There is a reason! Ask why?

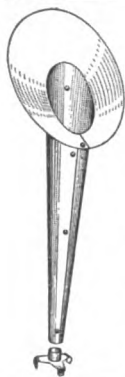
### Quality Loud Speaker

Unsurpassed in acoustic Quality and Tone Volume. No rough surfaces to obstruct and distort sound waves. No tin pasteboard or plaster used but of solid cast aluminum mirror finish sound chamber.

Filament Voltmeters .....\$3.75  
Baldwin Phones.....12.00  
Quality Phonograph loud speaker attachment .....10.00  
Bakelite Sockets.....1.00  
3" Bakelite dials......50  
Murdock Rheostats .....1.00

Watch for our new Variable condenser—smaller—more efficient and compact, than any other.  
Variometers Variocouplers with new special design winding.  
Ultra efficient single circuit tuner 125 to 2500 meters wave length.

## QUALITY RADIO SHOP, Richmond, Indiana



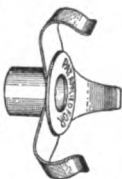
### Stramcy Products

#### STRAMCY LILY HORN

Made of fibre.  
Highest efficiency,  
Best tone quality,  
Lowest price.

#### STRAMCY COUPLER

Couples any Radio telephone to tone arm of principal makes of phonographs.



Dealers write to  
RADIO DISTRIBUTING CO.  
8 West Park St. Newark, N.J.

### Get Your Genuine Skinderviken Transmitter Button



Thousands used for  
**WIRELESS**

telephone and experimental purposes. Complete instructions sent with each button. Write for free literature.

**K-ELECTRIC CO., N. Y.**

15 Park Row, Room 612  
Price \$1.00 postpaid

## "SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps today for our new Catalogue L showing complete line of parts, raw materials and high grade apparatus.

Dealers: Write for our attractive proposition.

**The Shotton Radio Mfg. Co.,**  
INCORPORATED  
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## NEW MOTORS

FOR ALL PURPOSES  
STANDARD MANUFACTURERS  
PROMPT DELIVERY

ALL SIZES UP TO 5 H.P.

**We Specialize In Small Motors & Generators**

ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES

Largest exclusive Mail Order Small Motor dealers in the world.

CHAS. H. JOHNSTON, Box 119, West End, Pittsburgh, Pa.

**WIRELESS, TELEPHONE GENERATORS**  
500 VOLT - 100 WATT - 3400 R. P. M.  
FOR MOUNTING MOTOR GENERATOR SETS.

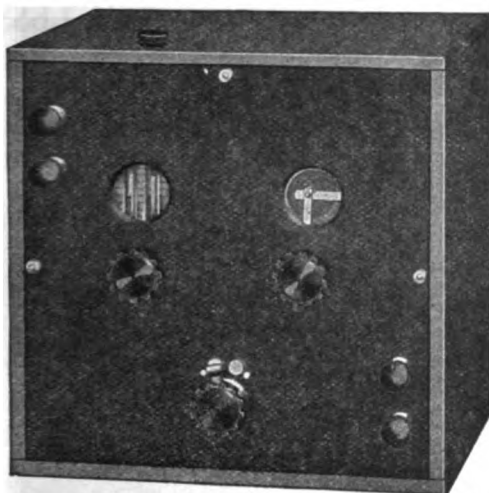
**\$28.50**  
EACH  
WRITE FOR CATALOG





# CAN'T YOU GET THE MESSAGES WHEN YOU HAV'N'T THOSE THINGS ON?

How Often Have You Had to Answer That Question?



Patiently you have explained to your visitor that only by keeping the phones on are you sure of getting the message, and that you have to write each word down as it comes in. But, oh boy! No more now! The Hall Relay will run it off on a sounder buzzer or ring a bell at the first impulse. If you use the tape recorder in connection with it, you get a permanent ink record on tape of each dot and dash. And as for time signals—Ring them off on a 20 inch gong if you like or blow a siren on NAA signals. If you get them good in the phones, the relay will do the rest.

## THE HALL RADIO RELAY

is manufactured solely by

**THE KARLOWA RADIO CO**

Rock Island,

Ill.

Place Your Order at Once To Insure Early Delivery

### STOP GUESSING

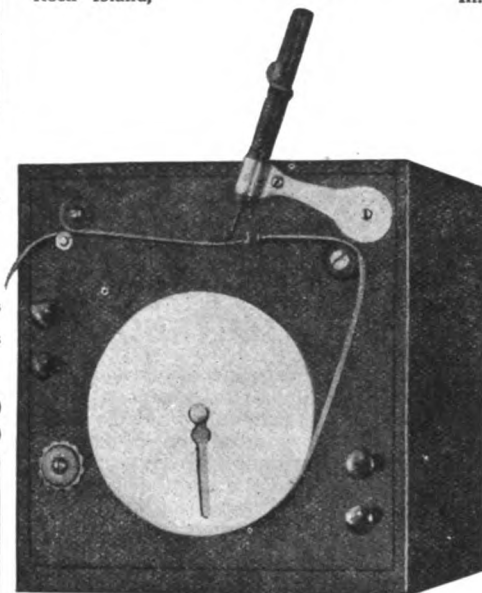
Make a Permanent Tape Record of  
Weather Reports

News Dispatches      Relay Messages  
Market Reports      Storm Warnings  
Stock Reports      Transatlantic Traffic

Put Those Time Signals on a Siren

Relay Complete.....\$125.00  
Tape Recorder.....35.00

Our new DeLuxe Catalog and Manual is ready for distribution. Fifty 9½ x 11½ pages full of the newest and only the best, in radio telephone and telegraph receiving and transmitting apparatus. A complete description of the Hall Relay is given. This manual will be mailed you upon receipt of 15c in stamps, which will be refunded on your first order of \$2.00 or more.



## IF IT'S RADIO—AND WORTH WHILE—WE HAVE IT

Our prestige has been built on the character of the merchandise we sell. Our service and quality giving ability, may be judged by the fact we distribute the products of the  
Radio Corporation of America

Clapp-Eastham Co.

Westinghouse Mfg. Co.

Wm. J. Murdock Co.

Acme Apparatus Co.

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Chelsea Radio Co.

Baldwin Phones

Eveready and Hipwell Batteries

Brandes Phones

DeForest Company

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Sole Manufacturers of Hall Relays and Recording Apparatus

The newest addition to the K line of wireless instruments is the K Vernier Attachment, a universal type, in that it is adaptable to any style condenser and dial. A small handsome knob that takes little room, does not project unduly, and does not "clutter" up the receiving panel.

There is no set in existence that is not improved wonderfully by the addition of this little device. In tuning CW and radiophones, a difficulty often experienced with the standard condenser is the impossibility of securing that exact adjustment required to bring in the music clearly, and free of troublesome and disconcerting back-wave screeches. The K-35 Vernier Attachment eliminates this. After a coarse adjustment by means of the dial, the little vernier button is pressed forward, and a slight turn either way, as needed, serves to bring in a maximum signal of clearness not obtainable by the first adjustment.

The K-35 Vernier Attachment is suitable for any instrument using a dial control.

K-35 Vernier Attachment, complete—45c—six for \$2.50—(Plus postage)

"Coatie" Key

We were the Originators of the  
"The Universal Vernier Attachment"

Unit Cabinet Receivers

## KARLOWA RADIO CO.

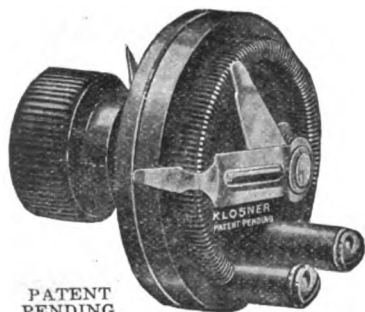
Main Office—606 BEST BLDG.,

ROCK ISLAND, ILL.

J. Edward Jones—Box 22—Palo Alto, Cal.—Pacific Coast Distributor

Clapp-Eastham Co.—Eastern Distributors

# MAKE NO MISTAKE THE KLOSNER VERNIER RHEOSTAT



PATENT  
PENDING

is the only Vernier Rheostat made having the exclusive feature of using but

## ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name KLOSNER moulded on the base.

Your dealer has them or send direct to us.

**PRICE \$1.50**

Shipping weight, One pound.

A two cent stamp brings interesting literature.

Made only by the Originators.

## The Klosner Improved Apparatus Company

Dept. Q4

2404 Crotona Ave., New York City  
N. Y.

# WARREN RADIO LOOP

NO  
A  
E  
R  
I  
A  
L



LESS  
S  
T  
A  
T  
I  
C

If Dad says—

**"NO AERIAL ON THIS HOUSE"**

don't allow his QRM to worry you but purchase a

## WARREN RADIO LOOP

The LOOP that made the Radio Roller Chair famous on the Boardwalk at Asbury Park, N. J.

Is just the thing for an apartment or den. Is light in weight and easily portable.

Is produced under a new principle of winding.

Is wholly enclosed, thereby protecting the winding.

Is used in place of an outside aerial.

Is a regular indoor aerial.

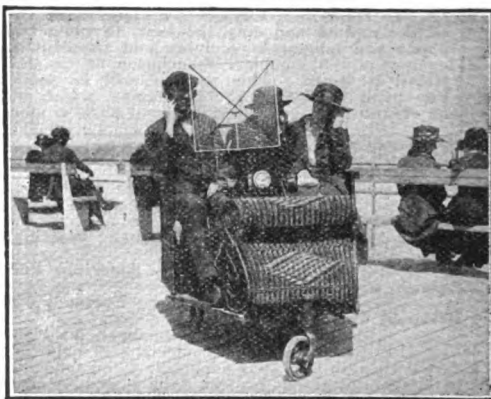
Is adapted for receiving in moving vehicles.

Takes the "tic" from static.

Eliminates all danger from lightning.

Can be used with any receiving instrument.

Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on "Wireless Age" and "Radio News" and featured in many other magazine and newspapers in the United States.

Send your order through your dealer or direct to us with his name.

Type-A-737 (300-700 meters) ....\$10.00

Type-A-7236 (175-1000 meters) ..\$12.00

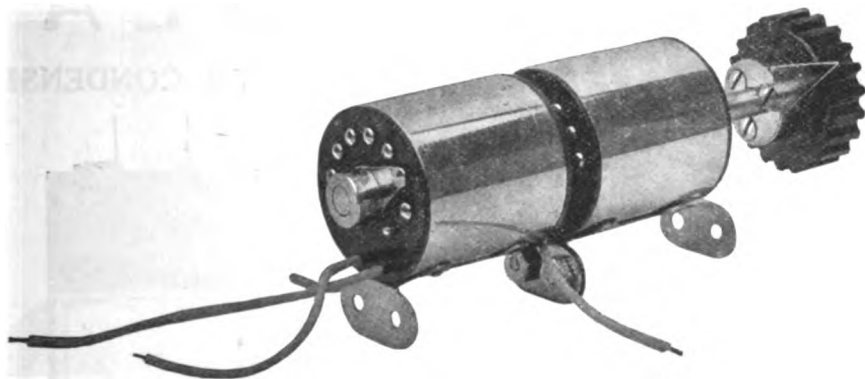
## V-DE-CO RADIO MFG. CO.

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. A101



# Radio Frequency Amplifier



Pat. Appl. For

There is nothing that opens up a wider field on the receiving end for the amateur and experimenter, than radio frequency amplification.

After an extensive investigation of the various types of tube couplings possible for radio frequency amplification, we have developed the above units (two are shown) with a view to giving maximum efficiency and greatest ease of control, at a reasonable price.

Tuning each stage is not necessary. Only one adjustment necessary to cover fairly wide bands of wave-lengths with several stages.

Transformers for several stages can be mounted in tandem with single control which greatly simplifies the manipulation of the set.

Remember that radio frequency amplification will increase the range, the selectivity and the satisfaction you can get from your receiver. A loop antenna will be far more effective with radio frequency amplification.

These units will cover wave-lengths from 180 to 750 meters.

**TYPE 5000 RADIO FREQUENCY AMPLIFYING TRANSFORMERS,  
\$5.50**

## COTO-COIL CO.

87 WILLARD AVE.,  
PROVIDENCE, R. I.

THE FOLLOWING DEALERS CARRY OUR APPARATUS—CALL IN AND SEE THEM

SOMERVILLE RADIO LABORATORY  
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STERLING HARDWARE & ELECTRIC CO.,

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NOLA RADIO CO.,

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JULIUS ANDRAE & SONS CO.,

Milwaukee, Wis.

INDUSTRIAL RADIO SERVICE,

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DETROIT ELECTRIC CO.,

Detroit, Mich.

WM. HALL ELECTRIC CO.,

Dayton, Ohio

SALZER ELECTRIC CO.,

Cleveland, Ohio.

WIRELESS MFG. CO.,

Canton, Ohio.

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PRECISION EQUIPMENT CO.,

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WESTERN RADIO CO.,

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ALTADENA RADIO LABORATORY,

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SCIENTIFIC EXPERIMENTER, LTD.,

Montreal, Canada.

# EVERYTHING *Radio!*

**W**E are authorized jobbers of the following companies:

**Radio Corporation**

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**Acme Apparatus Company  
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## PHILADELPHIA WIRELESS SALES CORPORATION

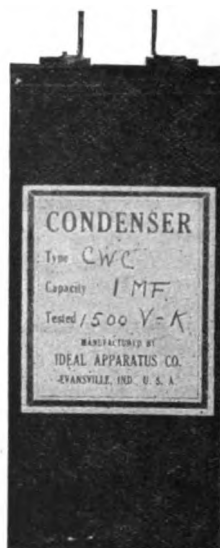
*Jobbers and Dealers in Radio.*



**1533 PINE STREET, PHILADELPHIA**

# I D E A L

## FILTER CONDENSER



**Type ICC**

The Ideal Condensers have met with great favor in radio circles throughout the country, all because of their super-efficiency.

Recently designed to stand potentials of 2000 Volts without puncturing, and at no increase in price.

These attractively priced condensers may be obtained from any of the dealers listed below. They will furnish you with complete information regarding the IDEAL LINE.

1 Mfd 2000 Volt Condenser .... \$2.00  
2 Mfd 500 Volt Condenser .... 1.50

Somerville Radio Lab., Boston, Mass.  
Benwood Company, Inc., St. Louis, Mo.  
Pitt. Radio & Appli. Co., Pitts., Pa.  
Hemple Electric Co., Omaha, Nebr.  
Klaus Radio Co., Eureka, Ill.  
Standard Radio Co., Los Angeles, Calif.  
Nola Radio Co., New Orleans, La.  
John R. Koch, Charleston, W. Va.  
Cino Radio Mfg. Co., Cincinnati, O.  
T & H Radio Company, Anthony, Kansas  
Wireless Mfg. Co., Canton, Ohio  
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**C-W CATALOG FREE  
IDEAL APPARATUS COMPANY  
EVANSVILLE,**

**"9XAH" INDIANA "9XAH"**



## Enjoy Wireless Music In Your Home

Hear, in your own parlor the marvelous wireless music, the prominent speakers, market reports and latest news before it is even on the press.

Get all this free entertainment and enlightenment when you want it without stirring from your fireside by installing an inexpensive receiving outfit and a

# STROMBERG-CARLSON RADIO HEAD SET

The No. 2-A Radio Head Set comprises four distinct units; two Receivers, Head Band and 5 foot Cord

### The Receivers

Receivers are equipped with a one-piece bipolar permanent magnet, of high grade magnet steel; provided with phenol fiber spool heads, slotted soft iron pole pieces, corrosion proof diaphragm, enameled copper wire coils. All parts are encased in a receiver shell of cast non-magnetic insulating material, that is unaffected by either moisture or temperature changes. Each coil is wound to 500 ohms. The coils are connected in series. This gives a combined resistance of 2000 ohms for the 4 coils of a No. 2-A Radio Head Set.

### The Head Band

A head band is furnished of the spring wire type, covered with heavy brown webbing, correctly shaped, light in weight and comfortable to the operator. Knurled thumb screws are provided on both ends to permit locking the adjustment after it is once fitted to the head. Exposed metal parts are nickel finished. Another feature of merit in regard to the design of this head band is a provision for separating the receivers which permits two observers listening in on a circuit simultaneously with but one Stromberg-Carlson No. 2-A Head Set.

### The Cords

Each No. 2-A Radio Head Set is equipped with a 5-ft. brown silk, moisture proofed, receiver cord which is forked in two branches, one branch for each receiver. This forked construction permits two persons to use the head set simultaneously when desired—a feature of great convenience.

PRICE \$7.50

**Stromberg  
Carlson Telephone Mfg.  
Co.**

Send me your free  
bulletin 1029-Q  
describing your No.  
2-A Radio Head Set.

Name .....

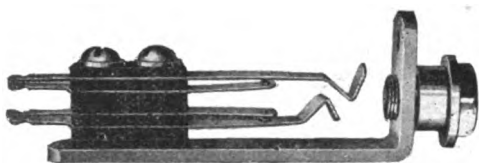
Address .....

Mail coupon for booklet 1029-Q describing these Radio Head Sets  
**Stromberg-Carlson Telephone Mfg. Co.**

ROCHESTER, N. Y.

Branches at Chicago, Kansas City, Toronto.  
Address nearest Office.

# FIRCO JACKS



FIRCO Jacks were not offered until our engineers were assured they had produced the best Jack on the Market. They are now working on some very radical innovations in Firco products, which will be announced in an early issue of this magazine.

These Jacks have heavy Sterling Silver Contacts, Special Alloy nickel-silver springs, giving highest resiliency. Single and Double Circuit closed. Single circuit open. Three spring and five spring automatic filament control.

## FIRCO BULL DOG PLUGS

*"The harder you pull, the tighter it grips"*

Used with Firco Jacks, the one plug that you DO NOT need a screw driver or soldering iron to connect.

*Immediate delivery through your local dealer.*

### John Firth & Co.

18 BROADWAY, NEW YORK

## Install this RTS Standard Detector Panel

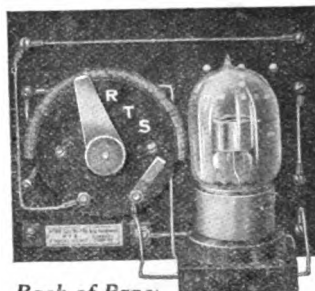


Front of Panel

ONLY  
**\$5.95**

Assembled  
(Without tube)

Prepaid by  
Insured  
Parcel Post



Back of Panel

# RTS

Here is a correctly designed panel made of best grade Formica. Its signal strength is unequalled by any other tested in our laboratory. The exclusive use of silver plated wire greatly increases its efficiency.

We guarantee the RTS Detector panel to be exactly as represented and will refund your money if you are not satisfied.

Order TODAY before the price goes up.

## RTS BUSHING LEVER

This Bushing Lever is well designed and beautifully finished. The knob is the well known Marconi type. Spring lever is 1 1/4" long with ground ends insuring smooth adjustment. A guide bushing raises the lever to proper height for all switch points.

PRICE 60c.

## New Catalog and Signal List

Send today for new illustrated catalog which also gives list of signal abbreviations.

## RADIO TESTING STATION

Dept. R-4, Sturgis St. BINGHAMTON, N. Y.

## FROM CAT WHISKERS UP—

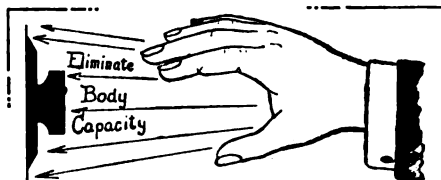
We can supply everything that's best in Radio. 1 or 101 of any article to user or dealer. Same day shipments.

*Inquiries are welcome*



**DISTRIBUTORS**  
Wholesale and Retail  
WESTINGHOUSE MURDOCK  
RADIO CORPORATION  
BRANDES, FEDERAL, DeFOREST  
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA



## Does Your Hand to the Knob Spoil Your Tuning?

You can Eliminate by sending 50c. for One, or \$1.00 for Three Sets of well-made Parts, Post paid, to equip your Instruments in a Few Minutes and Not change their Appearance.

State diameter of your dials.

## RADIO LABORATORY

259 Thomas St.

West Haven, Conn.

**Another**



**Achievement**

## The TELMACOPHONE

Here is the height of Telmaco perfection. Equipped with Baldwin Type C Unit, Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail.

Don't be misled into buying a loud speaker offered for less, and expect satisfaction; for a loud speaker of quality cannot be sold for less. Only after the most exhaustive tests and comparisons with the other loud speakers; and only after the most thorough research, laboratory tests, and field demonstrations has the Telmacophone been perfected, and offered now, for the first time to the public.

Telmaco Amplifiers, Receivers, Detectors, Variometers, and Variocouplers have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the Telmacophone.



*No extras to buy.  
Nothing to get out  
of order.*

Price  
Complete \$20.00

Fully  
Guaranteed

Price without Baldwin Unit,  
but with cap attached, \$14.00.

We advise the purchase of the Telmacophone without unit for those who have Baldwin Unit of their own.

If you haven't our complete catalog "P", be sure to write for it now. Dealers! We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

**RADIO DIVISION**

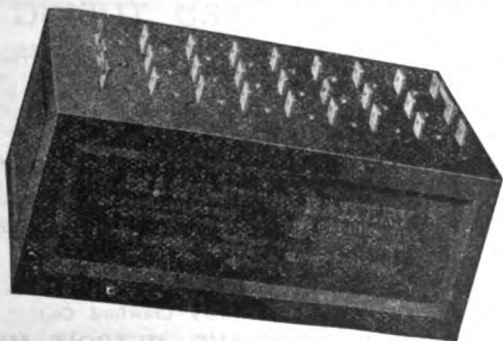
**Telephone Maintenance Co.**

**20 S. Wells St.,**

**NEW ADDRESS**

**Chicago, Ill.**

### BIESMANN STORAGE "B" BATTERY



Here's What the Radio World Has Long Been Looking for. No "B" Battery to be replaced. Takes care of Detector and Amplifier.

Twenty-four cells, individually tapped permitting use of any voltage from 2 to 50 volts in steps of two volts each.

Electrolyte is semi-solid; cannot spill or leak. Container is one piece cast composition block. Highly polished and neat in appearance. Pasted type plate especially developed for Radio Service.

Battery may be charged with any vibrating rectifier by using the circuit provided with battery. Copy of instructions furnished with each battery. PRICE - \$14.00  
Jobbers and dealers! Write for proposition without delay.

**RADIO DIVISION  
TELEPHONE MAINTENANCE CO.  
New Address: 20 S. Wells St., Chicago, Ill.**

# HOMCHARGE YOUR BATTERY for A Nickle

A perfect rectifier at last, fully automatic and fool-proof in every respect. It can be operated by anyone.



## The HOMCHARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is selfpolarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replaceable as a unit for \$1.00. The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than \$100.00. Bulletin 628 proves it. Ask for your copy.

Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. Cannot injure battery—will last a lifetime—approved by underwriters—satisfaction guaranteed. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price—\$18.50. (\$20 West of the Rockies.)

### ATTENTION MOTORISTS:

Send for special bulletin 58 showing how easy it is to "HOMCHARGE" your battery.

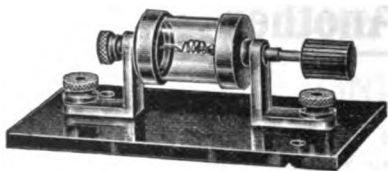
THE AUTOMATIC ELECTRICAL DEVICES CO.

127 West Third St., Cincinnati, Ohio

Canadian Distributors  
POWLEY & MOODY  
Ltd., Toronto



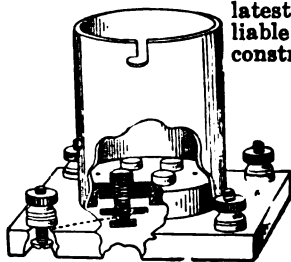
## Crystal Detector Stand, No. 1200



**\$2.45 Postpaid**

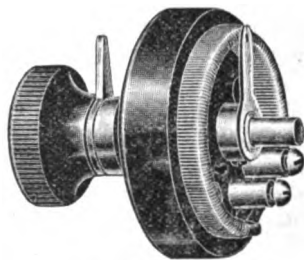
Dust-proof. No vibration. Flexible adjustment. Can be set rigidly.—Tested sensitive. Galena mounted in Woods metal sold @ 35c.

## Audion Bulb Socket, No. 1150



latest in absolute reliable contacts. Study construction shown in diagram. "ON TOP OF ALL" quality, and sells for \$1.00 only. Highly nickel polished & polished black compo base.

## Rheostat, No. 1175



is constructed with metal bearing for shaft, therefore more durable than others. Designed for use on panel or table. Resistance 5 ohms, \$1.00 postpaid.

## CONTINENTAL ELECTRIC CO.

117 East 129 St., New York, N. Y.

Get our prices for Switch Points, Binding Posts and other parts.

## THE RADIO ENGINEERING CO.

formerly

New England Radio Engineering Co.

Design and construction of special Radio Apparatus, complete installation of receiving and transmitting equipment.

Consulting service on Amateur problems with special attention to tube work.

Send 2c. stamp for bargain list.

**380 LaGrange Street  
BOSTON 32, MASS.**

## CARDBOARD TUBING

IN ANY LENGTH UP TO 28 INCHES

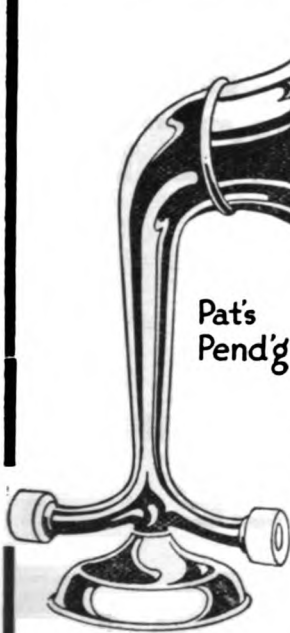
|  | Per in. or Fraction | Per Ft. |
|--|---------------------|---------|
| 2 1/2, 3 and 3 1/2 in. diameter . . . .            | 3 1/2c              | 30c     |
| 4 and 4 1/2 in. diameter . . . . .                 | 4c                  | 35c     |
| 5 in. diameter . . . . .                           | 4 1/2c              | 42c     |
| 5 1/2 and 6 in. diameter . . . . .                 | 5c                  | 50c     |
| 2 1/2, 3, 3 1/2, 4 in. diameter have 1/8 in. wall; |                     |         |
| 4 1/2, 5 and 6 in. diameter have 3/8 in. wall      |                     |         |
| Postage extra; shipping weight 1 lb. per ft.       |                     |         |
| NO stamps accepted on orders.                      |                     |         |

## MICHIGAN RADIO CO.

(Formerly Jeffery Crawford Co.)

2173 HILLGER AVE., DETROIT, MICH.

Price \$12.00 F.O.B. N.Y. City



# INTRODUCING THE KING "AM-PLI-TONE" A RADIO SURPRISE

**Listen to the Concerts, News and Dance  
with a KING "AM-PLI-TONE."**

Just slip your head phones on the "AM-PLI-TONE" and you and your friends will be SURPRISED.

Polished Cast Aluminum Body with Nickle Plated Base and Horn. No sheet Metal is used, the "Tinny" Sound is Left Out. The VOLUME is DOUBLED because TWO head phones are blended into one POWERFUL tone.

**A big hit—a big seller and immediate deliveries.  
Dealers and distributors what more can you ask?  
Write today for territory--KING "AM-PLI-TONE"**

82 Church St., New York City

NOTICE: All infringers of this device will be vigorously prosecuted.



Dept. R.  
MILLDALE, CONN.

#### RADIO PANELS—

Marked off, drilled, grained, buffed. Large holes cut for meters. Send drawing with exact dimensions for estimate. We guarantee quick service, accuracy and satisfaction.

#### RADIO PANEL SHOP

1103 S. Third St., Evansville, Ind.

#### SPECIAL PRICES THIS MONTH

On Grebe, Clapp-Eastham and  
Amrad Sets

#### MASSEY RADIO COMPANY

The Radio Store, Winchester, Va.

#### WIRELESS TELEPHONE AND RADIO APPARATUS (Complete Sets)

#### CLARK & MILLS ELECTRIC COMPANY ELECTRAGISTS

75 Newbury St., BOSTON  
Tels. Back Bay 365 & 366 & 8296  
1444 Massachusetts Ave., CAMBRIDGE  
Tel. University 1169

#### RADIO CONSTRUCTION CO.

Manufacturers of all kinds of Wireless Telephone and Telegraph apparatus. Panel drilling and engraving a specialty. Binding Posts, stops, switch points, nuts and screws of all sizes.

42 Maverick Square  
Winthrop Block East Boston, Mass.

#### SHREVEPORT

THE HEART OF THE FIFTH DISTRICT  
We stock leading makes of—

#### RADIO APPARATUS

MAIL ORDERS A SPECIALTY

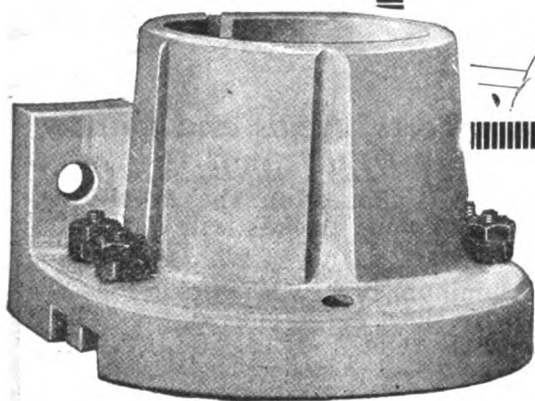
#### Shreveport Radio Supply Co.

P. O. Box 600, 222 Texas St., Shreveport, La.



# CROSLEY

## V-T SOCKET



PRICE

60¢

*Better—  
Costs Less*

Now the CROSLEY V-T Socket has been adopted by several of the leading manufacturers of radio apparatus, as standard in their products. There are many good reasons for this universal acceptance. Here are some of them.

The Crosley V-T Socket is made in one piece, of porcelain—the very same material that is used in the base of vacuum tubes—consequently it is of high dielectric value. The bayonet catch is imbedded in a heavy wall of porcelain, that is for all purposes, unbreakable. Soldering irons will not melt this socket and it is ideal for power tube work.

The design positively eliminates all possibility of short circuiting filament across high voltage B Battery.

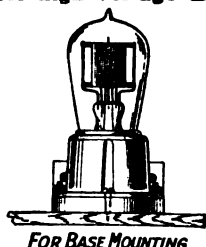
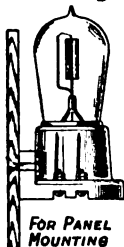
Almost every leading jobber and dealer in radio equipment, the whole country over, is handling the CROSLEY V-T Socket—NOW. The demand is heavy and its popularity is sweeping the country.

The low price needs no apologies—large production alone makes it possible.

Everyone now says the CROSLEY V-T Socket is “Better—Costs Less.”

Buy from your Dealer. He has it or can get it for you.

*To the few Jobbers and Dealers who are not handling the CROSLEY V-T SOCKET, we make the suggestion to get in line.*



# CROSLEY MANUFACTURING COMPANY

Radio Dept. Q-9,

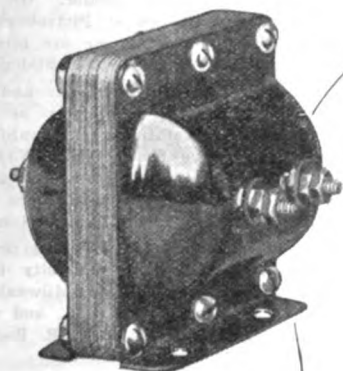
Cincinnati, Ohio



# Announcing the **CROSLEY SHELTRAN** *Audio Frequency Amplifying Transformer*

RATIO **9 TO 1**

*Completely  
Shielded*



HIGH grade materials and excellent workmanship, combine to give the CROSLEY SHELTRAN the great efficiency and attractive appearance so often lacking—except in the most expensive transformers. At the same time, we incorporated in the design of the SHELTRAN all the characteristics that are necessary to obtain maximum amplification from the modern vacuum tubes. These tubes with their high amplification constant, operate most effectively at large fluctuations in the grid potential. The ratio of turns is 9 to 1.

The CROSLEY SHELTRAN has a base area of  $1\frac{1}{4}$  in. x  $2\frac{1}{2}$  in., net weight  $12\frac{1}{2}$  oz. The overall length is  $2\frac{1}{2}$  in., overall height  $2\frac{1}{8}$  in. and the overall width is  $2\frac{1}{8}$  in.

Price complete, ready to mount....\$4.00

*Jobbers and Dealers:  
Order now for early deliveries*

**CROSLEY  
MANUFACTURING  
COMPANY**

Radio Dept. Q-9  
Cincinnati, Ohio

**\$4.00**

*Better-  
Costs Less*

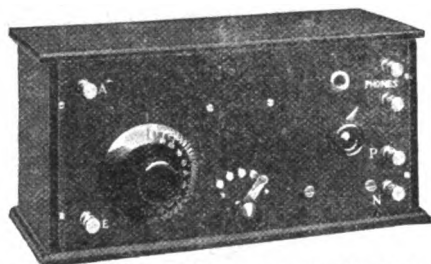
**CROSLEY VT SOCKET**

This graphically illustrates the increase in signal strength, when a single CROSLEY SHELTRAN is used as an amplifying transformer.

# Satisfied Users of HARKO SENIORS

## have written this advertisement

### Read what expert Radio men think of the CROSLY HARKO SR.



The HARKO SENIOR was developed to supply the demand for a low-priced, efficient receiving outfit, having a range of from 150 to over 600 meters, thus bringing in on the average amateur antenna—amateur stations, radio telephones and commercial stations, operating up to and including 600 meters. Ship and stations on the Atlantic Coast are easily copied in Cincinnati. Radio telephone concerts and voice, from Newark, New Jersey and other New Jersey phones in addition to Pittsburgh and other phones, are regularly copied in Cincinnati. It is just the thing for receiving radio telephone concerts.

This instrument is a combination tuner and audion detector. It consists of a tapped inductance, a CROSLY VARIABLE CONDENSER, CROSLY Model "A" Rheostat, CROSLY V-T SOCKET, CROSLY GRID CONDENSER and Leak. The hook-up is special—of our own design and is non-regenerative.

Parts are mounted on panel of formica or other similar dielectric composition. The whole thing is mounted in a mahogany finished cabinet 11½ inches wide, 6 inches high and 4¾ inches deep.

This set is very efficient. The price is remarkably low.

The HARKO SENIOR is sold complete as described without tube, "B" Battery, "A" Battery or phone, as is usual with such apparatus.

PRICE .....\$16.00

## THE CROSLY TWO STEP AMPLIFIER

**"Better — Costs Less"**

To meet the demand for a moderately priced, efficient two-step Amplifier we have developed the one illustrated on this sheet. This consists of CROSLY Rheostat, Sockets and Transformers, mounted on panel of formica or other similar dielectric composition, complete with binding posts which are marked and tap switch for changing from one to two steps.

The CROSLY TWO-STEP AMPLIFIER is designed to work well with practically any audion detector hook-up. The phone posts on the detector connected to input binding posts on the amplifier panel. The phones are then attached to the phone posts on the amplifier and the positive and negative posts connected with the "A" Battery. Two leads with clips come out of the rear of the cabinet to be connected with the "B" Battery.

The CROSLY TWO-STEP AMPLIFIER cabinet is designed to match up uniformly with either the CROSLY Detector Unit, the HARKO JUNIOR or the HARKO SENIOR. The size of the cabinet of the Two-step Amplifier is 11½ inch wide, 6 inches high, 4¾ inches deep.

Price of the CROSLY TWO-STEP AMPLIFIER without tubes, "A" or "B" Batteries, complete as shown in the illustration, is.....\$25.00

**Jobbers and Dealers Should Place Orders NOW for Early Deliveries**

**CROSLY MANUFACTURING COMPANY**  
Radio Dept. Q-9, Cincinnati, Ohio

"Have just hooked up the Harko Senior and Two-Step Amplifier. Detroit came in like a house-a-fire." Ray-Di-Co Organization, Chicago, Ill.

"Have received the Harko Senior. On test this set picked up the Radio phones at Pittsburgh and Detroit Tuesday night. On the whole we are pleased with the set." Ashtabula Radio Sales Co., Ashtabula, Ohio.

"I received your Harko Senior today and we gave it a trial and considering the simplicity of operation, it worked beyond our expectations. In conjunction with a Two-Stage Amplifier, we heard WBL, WJZ, KDKA and others. They were not loud but were quite clear and the most noticeable thing about it, there was no C.W. carrier audible." Romeo Radio Shop, Romeo, Mich.

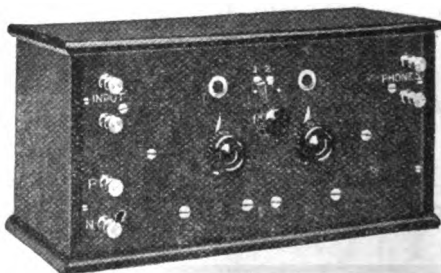
"We received the Harko Senior Receivers. We tried one of them out and had no difficulty in picking up Detroit voice and music, also from Milwaukee and Pittsburgh, Pa. They seem to work O.K., and we think they are wonderful for the money." H. R. Rodecker, Washington C. H., Ohio.

"Harko Senior O.K. We indorse same and back it with our own guarantee. Speaks for itself. Using one-step Amplifier and Harko Senior were able to hear Pittsburgh, Chicago, Detroit and NOF." Hoopeston Radio Shop, Hoopeston, Ill.

"We are in receipt of your Harko Senior Receiver and are certainly getting good results with it in this locality." Wright Electric Co., Scottdale, Pa.

"Last evening late I cut in and got Denver fine on the Harko Senior. Think I will have some business in a short time when the weather gets alright again." H. T. Hain, Lock Box 262, La Crosse, Kansas.

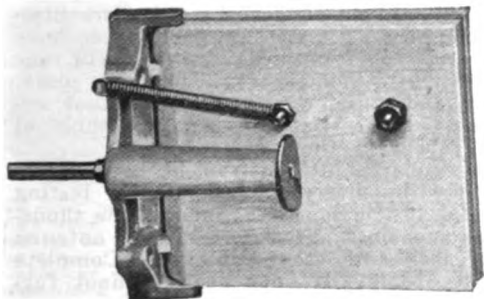
"We received your set and found it to receive all the musical concerts from KDKA and the like with the commercials coming in strong on 600 meters. It is a distance of nearly 800 miles from Pennsylvania as near as we can figure." Androscoggin Radio Supply Co., 42 Blake St., Lewiston, Maine.



# Crosley Variable Condensers

**"Better—Cost Less"**

Variable Condensers that do the work—that's the only kind we make. The Auto Electric Service, of Rockport, Maine writes:—"Our station has your Condensers in use and we get KDKA with a Two Step Amplifier loud enough to hear in the next room with the phones on the table. This we could not do with any other make of Condenser." It's the same story everywhere they are used.



**MODEL "C"**

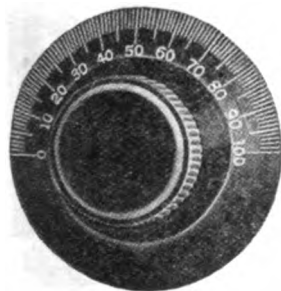
The principle of this instrument needs no introduction or explanation—it is made right and it works. This model differs from the other CROSLY models in the size of the plates, the material of which they are made and the capacity. The plates are made of porcelain, ground true on the contact surfaces before the copper and mica are applied. The capacity is conservatively rated at .001 Mf. and the extremely low capacity makes it ideal for use where a condenser is specified up to .001 Mf. capacity. It is especially recommended for radio phone work as it will not shower or break down, tested under a thousand volts. Furnished ready to mount on panel or in a cabinet, with  $\frac{1}{4}$  in. shaft standard or  $\frac{1}{8}$  in. shaft optional.

Price each, without knob and dial.....\$2.25

Same, with knob and dial..... 2.75

Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts ..... 3.50

## CROSLY KNOBS AND DIALS



Extremely well made of brass, stamped from a solid piece and finished with a high grade, durable black laquer. The figures stamped in the dial and enameled with white enamel. Overall diameter of dial  $2\frac{1}{2}$  in. Furnished for  $\frac{1}{4}$  in. shaft, standard or  $\frac{1}{8}$  in. optional.

Price, Knob and Dial complete

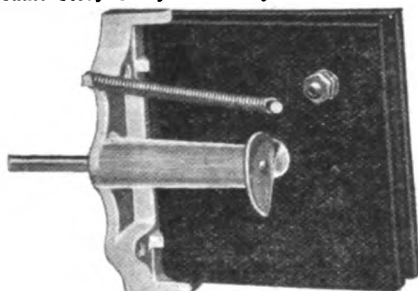
50 cents

Most Jobbers and Dealers are now carrying CROSLY VARIABLE CONDENSERS. If yours does not, send order to us direct, with your dealers name and address. We will ship prepaid.

# CROSLY MANUFACTURING COMPANY

Radio Dept. Q-9,

Cincinnati, Ohio



**MODEL "B"**

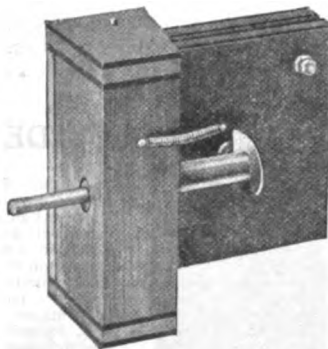
Like all CROSLY VARIABLE CONDENSERS the Model "B" has no appreciable body or hand capacity and is easier to tune in C.W. and I.C.W. than any other condenser made. Conservatively rated capacity, .0005 Mf., but tests in the Laboratories of one of the leading universities of the country have shown the maximum capacity of this model to never be less than .0008 Mf. and frequently running better than .001 Mf. The Model "B" CROSLY Variable Condenser has best quality laminated wood plates and a die cast metal frame. Extremely neat in appearance. Furnished, ready to mount on panel or in a cabinet, with  $\frac{1}{4}$  in. shaft as standard and  $\frac{1}{8}$  in. shaft optional. This model occupies a space on the panel of  $1\frac{1}{2}$ " x  $3\frac{3}{8}$ " and  $3\frac{1}{2}$ " deep.

Price, each without knob and dial.....\$1.75

Same, with knob and dial..... 2.25

Same, with knob and dial and mounted in mahogany finished cabinet complete with binding posts ..... 3.00

## MODEL "A"



This instrument needs no further introduction to radio men. Thousands have been sold and are now in use. The conservatively rated capacity is .0005 Mf. and like the other CROSLY models, it is a universal condenser for C.W. and other transmission work as well as receiving. Every CROSLY Variable Condenser

is tested to withstand 1000 volts before shipment. Just try this test on most air condensers providing you have no further use for the instrument. The frame of this model is made of wood; the plates are high grade laminated wood which function perfectly under all conditions.

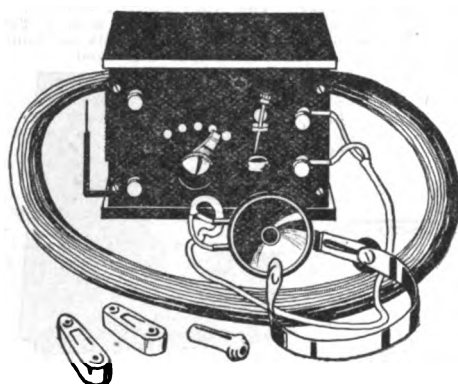
Price each, without knob and dial.....\$1.25

Same, with knob and dial..... 1.75

Same, with knob and dial and mounted in mahogany finished cabinet, complete with binding posts ..... 2.50

# CROSLY RADIO APPARATUS

"Better—Costs Less"



## HARKO RADIO RECEIVER

The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire. Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. \$9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. \$6.00 extra. Complete outfit \$15.00. If your dealer cannot furnish, we will ship direct prepaid.

## Crosley Radio Storage Battery

The CROSLY RADIO STORAGE BATTERY has been developed as a special "A" Battery for radio work and is especially designed to take care of vacuum tube filament current and other purposes where six volts are required.

Do not compare the CROSLY RADIO BATTERY with the three, five or seven plate lighting batteries generally offered for radio work. The CROSLY RADIO BATTERY is a standard 11 plate, heavy duty automobile type battery for radio work. It has greater than 80 ampere hour charging capacity.

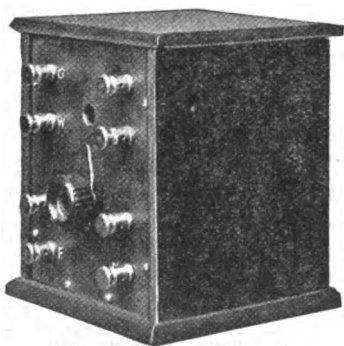
The size of the CROSLY RADIO BATTERY is 7 5/8 in. long, 7 15/16 in. wide and 9 in. high, overall.

Every battery is shipped fully charged and ready to hook to your vacuum tube or tubes.

Price each, fully charged .....\$17.00



## CROSLY DETECTOR UNITS

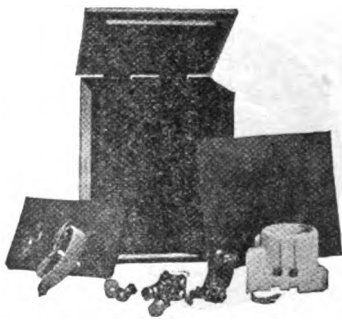


These are furnished in two ways:

Completely wired and mounted as shown on the left, or knocked down as shown on the right. Mounted—everything ready to hook to your set. Suitable for many different hook-ups. Formica panel: mahogany finished cabinet. Matches up with the CROSLY TWO STEP AMPLIFIER.

Price, completely assembled, as shown on the left.....\$7.50

Price of all parts, including formica or other panel or high grade dielectric composition, not drilled as shown on the right .....\$6.00



# CROSLY MANUFACTURING COMPANY

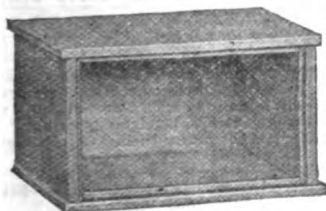
Radio Dept. Q-9,

Cincinnati, Ohio

# --More CROSLLEY RADIO PRODUCTS

"Better--Costs Less"

## Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various

sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbeted in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finish. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

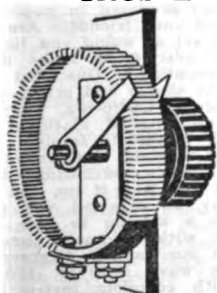
| For Panel Size | CABINETS Inside Dimensions |         |      | Mahogany or Quartered |        |
|----------------|----------------------------|---------|------|-----------------------|--------|
|                | High                       | Wide    | Deep | Gum                   | Oak    |
| 6x7            | 5 1/2"                     | 6 1/2"  | 7"   | \$2.50                | \$3.85 |
| 6x10 1/2       | 5 1/2"                     | 10"     | 7"   | 2.75                  | 4.40   |
| 6x14           | 5 1/2"                     | 13 1/2" | 7"   | 3.30                  | 5.55   |
| 6x21           | 5 1/2"                     | 20 1/2" | 7"   | 3.90                  | 7.30   |
| 9x14           | 8 1/2"                     | 13 1/2" | 10"  | 3.70                  | 6.80   |
| 12x14          | 11 1/2"                    | 13 1/2" | 10"  | 4.40                  | 6.80   |
| 12x21          | 11 1/2"                    | 20 1/2" | 10"  | 5.25                  | 10.60  |

Cash must accompany order. No C.O.D.'s. We pay transportation charges.

## FORMICA PANELS

We can furnish genuine formica panels 3/8" thick, cut to the following dimensions: 6x7; 6x10 1/2; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2 1/2¢ per square inch. For odd sizes order the next largest size: we will trim. We pay postage.

## CROSLLEY RHEOSTATS



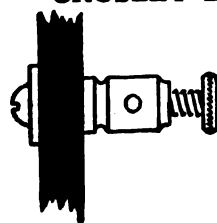
Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including 3/4": non-corrosive resistance wire.

Model "A"—overall diameter 1 1/2". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60¢ each.

Model "B"—Resistance 4 ohms: will carry 3 amperes without heating. Suitable for detector, where very

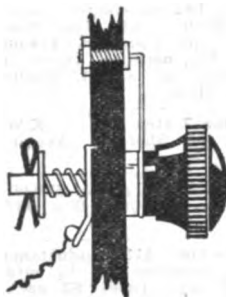
accurate adjustment is required and for 5 watt power tubes. Price \$1.25.

## CROSLLEY BINDING POSTS



Barrel 3/8" x 1/2". Not too small nor too large, just the right size.

Nickel plated. Complete with base screw and washer as illustrated. Price, 8¢ each or 90¢ per dozen.

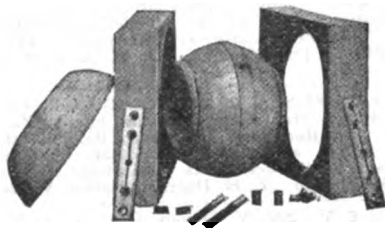


## CROSLLEY TAP SWITCHES

Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price 40¢ each. Better—Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut, 3¢ each, 30¢ per dozen or \$2.50 per hundred.

## CROSLLEY VARIOMETER PARTS



This set consists of two stators, one rotor, the necessary hardware shown in the illustration. Shaft for knob and dial is 7/8" diameter. The wood parts are furnished either in poplar or mahogany.

The average radio man has his own ideas about the kind of wire and the number of turns that he wishes to use, depending upon its purpose, so we leave that to the purchaser. The operation of winding and setting up is very simple, but the parts that we list are difficult for the amateur to make.

They are made in our own large wood working plant on special automatic machinery that make possible very accurate quantity production.

Price of Variometer parts, described above, made of poplar wood, is \$1.50 (including wood parts and hardware).

If wood parts are made of mahogany \$1.75.

If winding form is desired, it can be used for winding one or more variometers. Price is 30¢ additional.

## CROSLLEY VARIOCOUPLERS



CROSLLEY VARIOCOUPLERS consist of formica tube, rotor and brass hardware. It is made with the same care and accuracy as the CROSLLEY VARIOMETER.

Price, complete as shown in the illustration, not wound or assembled, \$1.50. Rotor only 40¢.

If your dealer does not handle any of the above parts, you may order direct. We will ship prepaid. Dealers and Distributors: Every item shown above should be in your stock. Write for proposition.

**Crosley Manufacturing Company**  
Radio Dept. Q-9,  
Cincinnati, Ohio

# CLASSIFIED ADVERTISEMENTS

Five cents per word per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for succeeding month's issue.

**WANTED:** 500 Volt, 100 Watt Generator. State all particulars. R. H. Beaumont, Jr., Radnor, Pa.

**FOR SALE:** General Radio type 145 wavemeter, (new) \$35.00; Amrad wavemeter, \$6.00. 43 plate \$167 Murdock condenser. Station type Vocaloud, \$24.00. Packard 1KW transformer. Regenerative tuner in cabinet, \$22.00. 2-step amplifier in cabinet, \$26.00. Arthur L. Walser, Chesaning, Mich.

**SELL:** Regenerator \$30, detector 2 step \$25, 1/4 K.W. set \$25. Inquire J. Pascal, 85 Sherman Avenue, Staten Island, N. Y.

**SELL:** Tresco all-wave tuner, detector panel, \$70.00; or Tresco regenerative, detector, \$40.00. Box 967, Ogden, Iowa.

**C.W. STUFF:** Tuska Transformer \$13, Inductance with clips \$6, rheostat \$2.50, ammeter \$5, 1/2 mfd. condenser \$1, 2 burnt out 5 watt tubes \$2 each, P. Lindauer, 1014 11 St., Lorain, O. 8CER.

**3JI Is Calling! Please Stand By!** Calvert's Short Method of Learning the Continental Code. Printed on highly-glazed cardboard 7x16 1/2 inches. 35c brings it to you with a copy of International Abbreviations, free! Positively, one of the simplest methods ever devised. This issue only at this price. 3JI Now Signing Off. 1 Pay Postage. G. W. Calvert, Lansdale, Pa. 3JI.

**FELLOWS HERE'S A BARGAIN:** 9DP will be sold. 1 K.W. Spark Transmitter, Switch board, Paragon, Universal Arc Receiver, Two step, Baldies, storage batteries, aerial, etc. \$340.00 takes all radio apparatus I have. Will sell parts separately. Write for list and description. E. H. Hartnell, Salem, Wisconsin.

**WANTED:** 6 V., 350 V. Dynamotor. A. J. Higson, 84 Romaine Avenue, Jersey City, N. J.

**MUST SACRIFICE Super Regenerative:** Perfect phone reception, 180-600 meters Turney Regenerative, audion and crystal detector, two stage amplification, external tuner and tickler connections, three condensers with verniers, vernier detector rheostat, Formica panel, telephone switch controls, jacks. Complete with bulbs, B battery, Connecticut phones. \$75 First money order takes. Arthur Osborn, 311 E. Daniel, Champaign, Ill.

**SELL:** Efficient 1/4 K.W. Transmitter, complete; including Dubilier Condenser. Enclosed Rotary and Marble Control Panel for best offer. Clarence M. Voll, 49 Pawnee Parkway, Buffalo, N. Y.

**COMPLETE STATION EQUIPMENT OF 8BQ:** 1KVA transmitter with D.X. record. Grebe CR-2, Det. 2 stage with all accessories. Very reasonable, guaranteed. H. Walleze, Danville, Penna.

**WANTED:** 2 Western Electric V.T.'s. J. Weiss, 219 East 83d St., New York City.

**1/4 K.W. TELEFUNKEN** 500 cycle transmitter mounted heavy engraved bakelite panel, aluminum angle frame complete with meters, key rheostat, self-excited generator and AC motor mounted on rubber, spare gaps, condensers, \$300.00. Radiophone on bakelite panel, with two new VT2a, transmitter, switches, condensers, dynamotor 30-350 volts \$60.00. All F.O.B. Seattle. Fotos. Obradovic, 5103 Meridian, Seattle.

**AERIAL WIRE**—100 foot coils; 7 strands \$22 Hard Drawn Copper 90c; Tinned \$1.50; No. 14 Hard Drawn Copper 85c; Postage weight 2 pounds per coil. Chas. L. Manning, 1558 Miller Street, Utica, New York.

**BARGAIN:** One Kilowatt Type H-1 Acme, panel mounted \$25. Benwood Aluminum Enclosed Gap and R & M 3400 RPM Induction motor \$30. Both \$50. Guaranteed A-1 Condition. Still being used. Radio 9VZ, C. W. Kleman, 2011 Garrard Street, Covington, Ky.

**FOR SALE:** 2 C. D. Tuska Variometers, one Radio Shop coupler and dials. Price \$15. H. A. Williams, 204 S. Third, Bozeman, Montana.

**AMATEURS**—Write for list of receiving apparatus. Good condition. B. Dudley, 4909 Fletcher St., Chicago.

140

ALWAYS

**SELL**—1 KW Type T2 Thordarson \$24; oil immersed condenser \$15; Benwood gap with standard motor \$15; Murdock line protector \$4; Acme anti-light-blinker \$6; heavy United Wireless 10 amp. key \$4; Holtzer Cabot 3000 ohm phones, like new \$7. All good condition. First money order takes all or sold separately. Paul D. Mohr, Emma, Penna.

**EDISON B BATTERY ELEMENTS.** Make your own. Can be recharged and lasts for years. 200 ampere hour A batteries, guaranteed, \$35.00. Harry Morrell, 52 Goffe St., New Haven, Conn.

**BARGAIN;** One K.W. Thordarson Flexible transformer \$15. Thordarson Oil Condenser \$15. Thordarson Oscillation Transformer \$5. Gap motor with Thordarson disc \$6.00. Kermel aerial ammeter \$5. Overland Key \$3.00. All guaranteed. J. Pinkston, Valdosta, Ga.

**SELL:** Duck Co.'s one-step with Federal—New—\$10.00 prepaid. J. D. Blitch, Lexington, Va.

**RADIOTRON DETECTOR** \$4.00. Amplifier \$5.00, new tubes. Both \$8.75. Prepaid. Wesley Robinson, Jr., St. Marys, Georgia.

**WE CAN SHIP IMMEDIATELY**—Burgess 22 1/2 volt "B" Batteries \$3.00 and the following Rhamsatine products—Adapt-O-Phone \$12.00, Amplifying Transformer \$3.50, Socket \$1.00, Plug and Jack \$1.50, Jack only \$0.85. Postage prepaid. The L and B Radio Shops, Dept. Q, 6185 McMillan Ave., Detroit, Michigan.

**FOR SALE:** DeForest RS200 utility receiver \$20.00, 3 circuit regenerative detector and one step \$50.00, 1/4 HP 1400 R.P.M. 25 cycle motor \$15.00, 1/10 HP 3400 R.P.M. 60 cycle new \$19.00 and new 1/4 HP 1750 R.P.M. 60 cycle motor \$14.00. Thomas A. Reid, 8CLD, Springfield, Ohio.

**WANTED:** O.T., changeover switch, etc. 1CUK, J. W. Packard, Canton, Mass.

**C.W. TRANSFORMERS** Unmounted. 200 watt with one 550 volt secondary \$8.00; with two 550 volt secondaries \$8.50. All have 350 volt taps. Postpaid. Money back guarantee. Milton Zumpe, 1332 Mishawaka Ave., South Bend, Ind.

**BUILD YOUR OWN WIRELESS** Telephone and Musical Receiver, Don't Wait for a Set. We Hear Chicago, 900 Miles, Fine on Good Nights. Pittsburgh, Newark and New York Come in Good and Loud—You Can Do the Same on a Single Bulb. There is Radio Music in the air each evening, and the living voices of the artists can be reproduced in your own home and enjoyed by you and your friends. Are you satisfied with your receiving set or would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting? One that will be equal to any regardless of claims and price—with which you can hear Honolulu, California, German, South American, French and English stations and practically all of the high powerful foreign and domestic stations, as well as amateur stations as far west as New Mexico, and the phone and music. Anyone can assemble this outfit and wire it up, and the remarkable ranges that may be obtained will surprise you. Why not make a set up to date and efficient? Don't experiment with unknown circuits. We will promptly mail you our sample diagram of a complete short and long wave receiver 175 to 20,000 meters, together with complete instructions for wiring and assembling, price of each part and where they can be bought, leaving nothing to guess about, on receipt of fifty cents in coin or stamps. Here is a diagram no one can afford to be without. Virginia Novelty Company, Desk A, Martinsburg, West Va.

**1000 VOLT 750 WATT D.C.** generator excellent condition \$70. C.W. transformer 500 watt 10 and 500 volts \$10. Twin cylinder Indian motorcycle engine slightly used \$40. Philip Stout, 1621 Riverside Drive, Knoxville, Tenn.

**STOP! LOOK! and ACT!** V.T.'s ACCESSORIES! With each of the listed tubes Radiotron U.V.200 \$5.00 and A.P. Moorhead detectors \$6.00; Radiotron

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U.V.201 \$6.50 and A.P. amplifiers \$8.50; We will supply free of charge your choice of either of these six premiums—Latest FADA rheostat \$1.00, No. 810 Remler Smooth Running Rheostat \$1.00, Paragon V.T. socket \$1.00, Murdock V.T. socket improved contact type \$1.00, DeForest V.T. socket \$1.00, FADA panel mounting V.T. socket Bakelite base \$1.10. Either of the Federal single, closed or double circuit jacks listed respectively at \$0.70, \$0.85 and \$1.00 will be given as premiums with each Federal 226W amplifying transformer \$7.00 or R.C. of A. U.V.712 \$7.00 and the U.V.1714 Radio Frequency Amplifying Transformer. FADA 5 ampere Nichrome power rheostats \$1.35 or R.C. of A. U.R. 542 Porcelain V.T. socket supplied free of charge with each \$6.00 U.V. 202 power tube or A.P. Moorhead 5 watt Type C power tube \$7.50 for C.W. or Radiophone transmission or power amplification. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Twelve hour service. Postage and insurance prepaid by us, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. Q, Abilene, Kansas.

**RADIO APPARATUS** built to order. Send diagram and description for estimate. Amplifiers a specialty. C. C. Pidgeon, 1343 Clifton St., Washington, D. C.

**BKUMA YRLSBUG** Beginners do master Wireless Code thirty minutes to two hours after limited practice do pass Govt. examination obtain license. Forty page Booklet information and reports from 240 successfully self instructed beginners mailed for ten red stamps. Dodge, Box 210, Mamaroneck, N. Y.

**Variometers \$3.00; Vario-couplers \$3.00.** Immediate shipments. Benger-West Mfg. Co., 135 Cooper St., Brooklyn, N. Y.

**EDISON ELEMENTS,** Insulators and connecting wire 10c per pair. Information given for making B batteries. E. Pierson, 728 7th St., Niagara Falls, N. Y.

**WIRE SPECIAL!** 1/2 lb. spools D.C.C., No. 26 Wire, 80c; 24 D.C.C. (Just the thing for your inside aerial) 100 ft. coils, 75c; 7 strand-22, copper aerial wire, 100 ft., 80c; 250 ft., \$1.80; 300 ft., \$2.25; 500 ft., \$3.50; 1000 ft., \$6.90. Send Money Order. We Pay P.P. Insurance. Star Cabinet & Radio Shop, Lansdale, Penna.

**SELL:** Navy type loose-coupler, \$5.00; 1 KW Packard, \$10.00; Ford coils, \$1.00 each. F. B. Hoselton, Webb City, Mo.

**500 VOLT GENERATOR,** \$15.00; 1/4 h.p. R. & M. Induction Motor, \$15.00; Acme 200 watt mounted CW Transformer, \$15.00; Acme 150 watt filament heater \$10.00; 2 Amrad basket balls, \$5.00 each; 80 amp Storage Battery, New, \$15.00. A. Hengelbrok, 922 Washington, Newport, Ky.

**FOR SALE:** \$175.00 worth of New Standard Radio equipment. Champ Clark, Anthony, Kans.

**AMRAD** synchronous motor, Benwood rotor, electrodes complete \$28. 1PI.

**REGENERATIVE RECEIVER.** Combined medium wave cabinet and detector two-step. Fine on 200 meter C.W. Worth \$125. Sell \$55. Brandes Superior \$5.50, variable \$2.50, variable fixed, eighth horse induction motor \$10, crystal detector, lead coil, Amrad dials, baby knife switches. Few sockets, amplifying transformers, rheostats. O. R. Wimpy, 116 Sheets, LaFayette, Indiana.

**FOR SALE:** Thordarson half kilowatt Transformer, Dubilier Condenser, Benwood Rotary without motor, International Radio Oscillation Transformer, 0-5 Ammeter Dubilier Kickback Preventer. Has worked five hundred miles. Bargain at \$75. H. C. Richards, 254 Main St., Norwalk, Conn.

**RECTIFIER PLATES** for C.W. 72 square inch piece of aluminum \$0.75. 72 square inch piece of lead \$0.60. Log book 100 pages 50 cts. Philadelphia Radio Supply, 5714 Hazel Ave., Philadelphia, Pa.

**NAVY STANDARD** 1/2 KW Quenched 500 cycle Panel Transmitter with automatic starter and Motor-generator. Tunes up to 952 M., good condition \$225. Marconi 1/2 KW Synchronous 500 cycle Cargo Type Transmitter with Motor-generator \$110. French 1/2 KW Field-transmitter \$47.50. Other Government Apparatus Cheap. Eaton, 1915 S. Twelfth, Phila., Pa.

**DUAL GRIP CLIPS** Lock to your A or B battery terminals. Can be used for tapping the circuit anywhere at one tenth the cost of plugs and jacks. Post paid, 25c each or 5 for \$1.00. Variable B batteries,

22 1/2 V., \$2.00 & \$3.00. Assorted coil springs, 75 for \$1.00. The Dual Tool Company, 12428 Euclid Ave., Cleveland, Ohio.

**FOR SALE:** New 25,000 volt Thordarson \$30.00. Coaradio O.T. \$12.00. Klitzgen gap \$18.00. All for \$58.00. Write for details. 7LN.

**ALUMINUM.** Absolutely pure machine cut aluminum strips for chemical rectifiers, 1/4 in. stock, 6 in. long; 1/2 in. wide 10c, 3/8 in. wide 8c. Radio Aluminum, 13 Grant St., Natick, Mass.

We have plant and equipment to manufacture complete components or parts for wireless apparatus, for distributors and manufacturers. Based on extensive mechanical experience, our production and workmanship will compete with market demands. Diamant Tool & Mfg. Co., Inc., 91-97 Runyon St., Newark, N. J.

**SPECIAL RADIO BATTERY:** The same as used by 2BML in Transatlantic Test, Capacity 80-Ampere hours. Case will not absorb acid, therefore will not stain floors. Price \$22.00. Neils Larsen, Riverhead, N. Y.

**DETECTOR PANELS** \$4.50, wood variometer not assembled \$9.50. For DX work, Tesco tuner \$5.75 each. Crystal detector \$1.75. 5 watt CW set \$25.00. West Electric V.T.2, each \$7.25. Swap 350 volt motor-generator set type Midget, new 20 watts. Other bargains, send stamps for list. Mack's Radio Shop, Ansonia, Conn.

**FOR SALE:** Grebe CR3 \$40.00. Grebe detector and two step with bulbs \$60.00. Thordarson 1/4 K.W. enclosed Signal Gap, Murdock Oscillation and five sections Murdock condenser. Complete set \$25.00. General Radio five amp. H. W. A. \$5.00. Brandes Navy Phones \$5.00. E. P. Dooley, 719 E. Miner St., South Bend, Ind.

**WANTED:** Wavemeter Navy type S.E. 965 as advertised December QST page 72. Also want used Wireless course complete. C. Bramer, 2140 South Harding Ave., Chicago.

**FOR SALE:** Condenser Acme bargain. Cannings, 4249 Russell, St. Louis.

**40% OFF LIST PRICES**—of parts used (parts cost \$112.45) takes 15 watt (3 tube) CW & fone set now in use at 9ANR. 0-3 HWA, \$4.75; UV203 socket, \$1.75; P537-15 amp. rheostat, \$7.85; Marconi VT-1, \$2.65; New 2 fil. audiotron, \$4.25; used 1 fil. tron, \$2.25, amp. trans. \$2.75. F. Pierce, 2415-19 Ave., Rock Island, Ill.

**SELL:** OT-10 DeForest Radiophone transmitter, without motor generator, used only a few times; Grebe CR-3 receiver. Best offer takes them. James P. Buxton, Patchogue, N. Y.

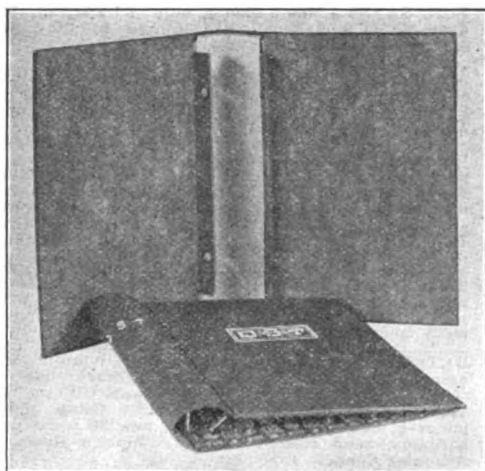
Preparing for college and will sacrifice entire up-to-date high power radio outfit as follows: \$55 Z-n-tode regenerator \$40. \$45 Profoot detector and 2-step amplifier \$35. \$15 Western phones \$8. \$20—100 amp. hour battery \$10. 3 tubes (Marconi and electron relay worth \$20) \$10. \$15 loud talker \$5. Entire lot as above for quick sale \$90. Also \$75—500 v. Motor generator \$45. \$15 Acme 375 v. C.W. transformer (never used) \$10. \$45 Thordarson 1 kilowatt "R" \$25. Benwood gap with induction motor (worth \$50) \$30. Also miscellaneous C.W. equipment send for list. Above equipment in perfect condition and good as new. Harold Lewis, 323 Wesley Ave., Oak Park, Ill.

**FOR SALE:** One K.W. spark transmitter complete \$70. For further information write Robert Faudree, Chester, W. Va.

**BUILD RADIO SETS.** We supply parts or complete units. Catalog 15 cents. Easily understood assembly drawings. Crystal Detector Set, Non-regenerative Receiver, Regenerative Receiver, 2 Step Amplifier 25 cents Each. All five \$1.00. No stamps accepted. Hatfield Airfone Company, Owego, N. Y.

\$25.00 buys my 1/2 K.W. spark complete. A bargain! P. T. Perdue, Salem, Va.

**BARGAIN FOR SALE CHEAP:** Complete 1 KW. Synchronous Spark transmitter consisting of Benwood 10" disc, Aluminum housing, 1/4 horsepower Synch. motor, Mahogany cabinet with oil immersed glass condenser, 1 KW Thordarson Silicon steel transformer, Marconi Key with 1/4" silver contacts, Marconi Aerial Switch with base insulators, Thordarson Oscillation Transformer, St. Louis Battery charger. All for \$100.00. Everything new and best working condition. Lewis Pupich, 2312 Greenview Ave., Chicago.



**BINDER WITH TWO CLIPS  
POSTPAID—\$1.50**

There is only a limited supply of these binders on hand, which we will furnish for \$1.50 apiece, with two clips, postpaid. Act NOW and avoid disappointment. Address your order and make your remittance payable to

**THE AMERICAN RADIO RELAY LEAGUE, HARTFORD, CONN.**

## QST Readers!

Your set looks better and works easier in a cabinet than it does strewn all over a table, doesn't it? Right!

Your copies of QST are as valuable to you as your pet pieces of "junk." Of course!

You no longer have to stack your magazines in an unhandy pile, or scatter them around where the copy you most wanted to keep will likely get lost. We are illustrating herewith the "QST Cabinet," a binder especially made up for preserving your QSTs, keeping them clean and together in order for quick and easy reference.

The QST binder is in dark red with gold "QST" on back and front. To mount your QSTs, just punch two holes through the binding edge of the magazines, string them on the two clips we furnish, and fasten through the eyelets shown in the cut.

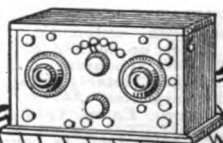
## TUSKA



The Tuska Variocoupler is completely moulded. The rotor and primary are wound with green silk wire. Not only is the instrument striking in appearance but highly efficient in design.

Send 5c for Catalog #2

**THE C. D. TUSKA CO.**  
HOADLEY PLACE, HARTFORD, CONN.





—FOR YOUR CONVENIENCE—

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ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

COMPLETE    **\$258.50**

*Erect aerial, hook on batteries,  
insert tubes and listen*



## *Unexcelled for C. W. reception*

**T**ESTED, proven units are combined in this outfit to make a complete set without a weak link. The tuner is the famous Paragon R.A., Ten regenerative receiver,—the worlds leading short wave tuner. To this is added its companion instrument, Paragon DA-2 Vacuum Tube Detector and two-step amplifier. Then comes the Radio Magnavox, which sends wireless telephone concerts as well as code, clearly all over a room or hall without detracting from the original tonal qualities. For sharp tuning head phones are provided—Baldwin type "C" standard of the world. Every item of accessory equipment is supplied—of a quality consistent with the Paragon instruments that form the heart of this set. This includes 3 Radiotron vacuum tubes, 3 Eveready "B" Batteries,

1 60-80 Ampere-hour storage battery, specially built for radio work, and our Number 3 antenna equipment, with wire and insulators for a 4 wire 100 ft. aerial, lead-in wire, ground clamp, etc.

Not a single item is omitted for a complete installation. The actual work of installation is reduced to a minimum. Simply put up your aerial, insert tubes, hook-on batteries, make an easy ground connection—and you are ready to listen.

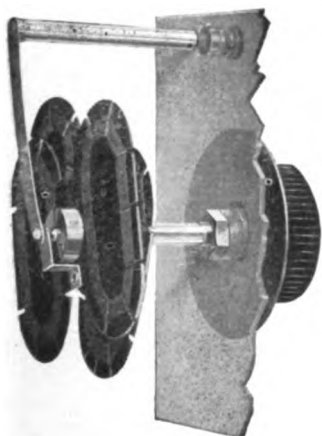
The price complete is \$258.50. Quality considered, we confidently recommend this outfit as today's best buy in radio. If you live in New York examine this equipment at the Continental store. If you live farther away, order by mail. Shipment immediately, by express, accompanied by the Continental guarantee of satisfaction.

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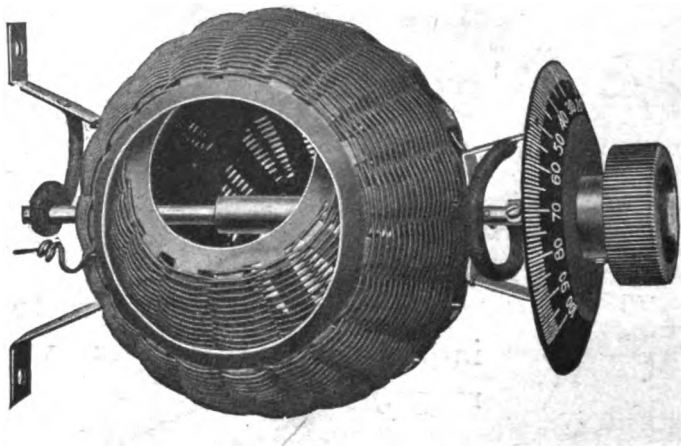
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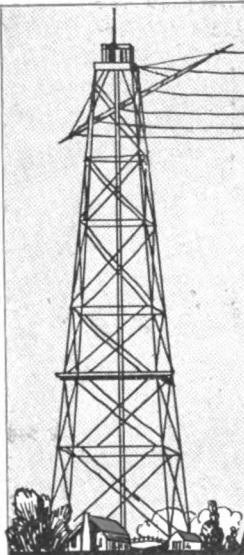
# QST

Published by the  
**AMERICAN RADIO RELAY LEAGUE**  
and Devoted exclusively to  
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*The  
Progress of  
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**MAY  
1922  
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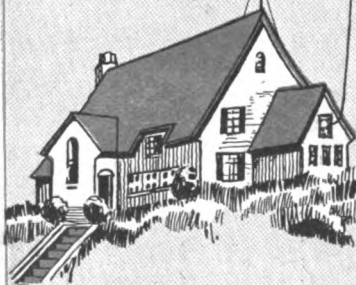
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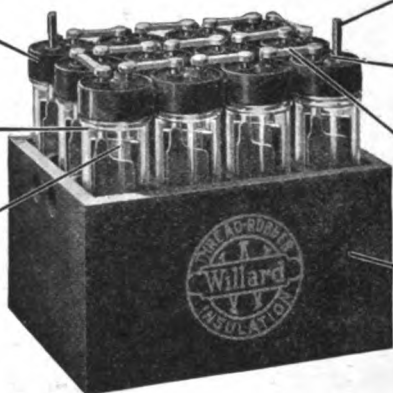
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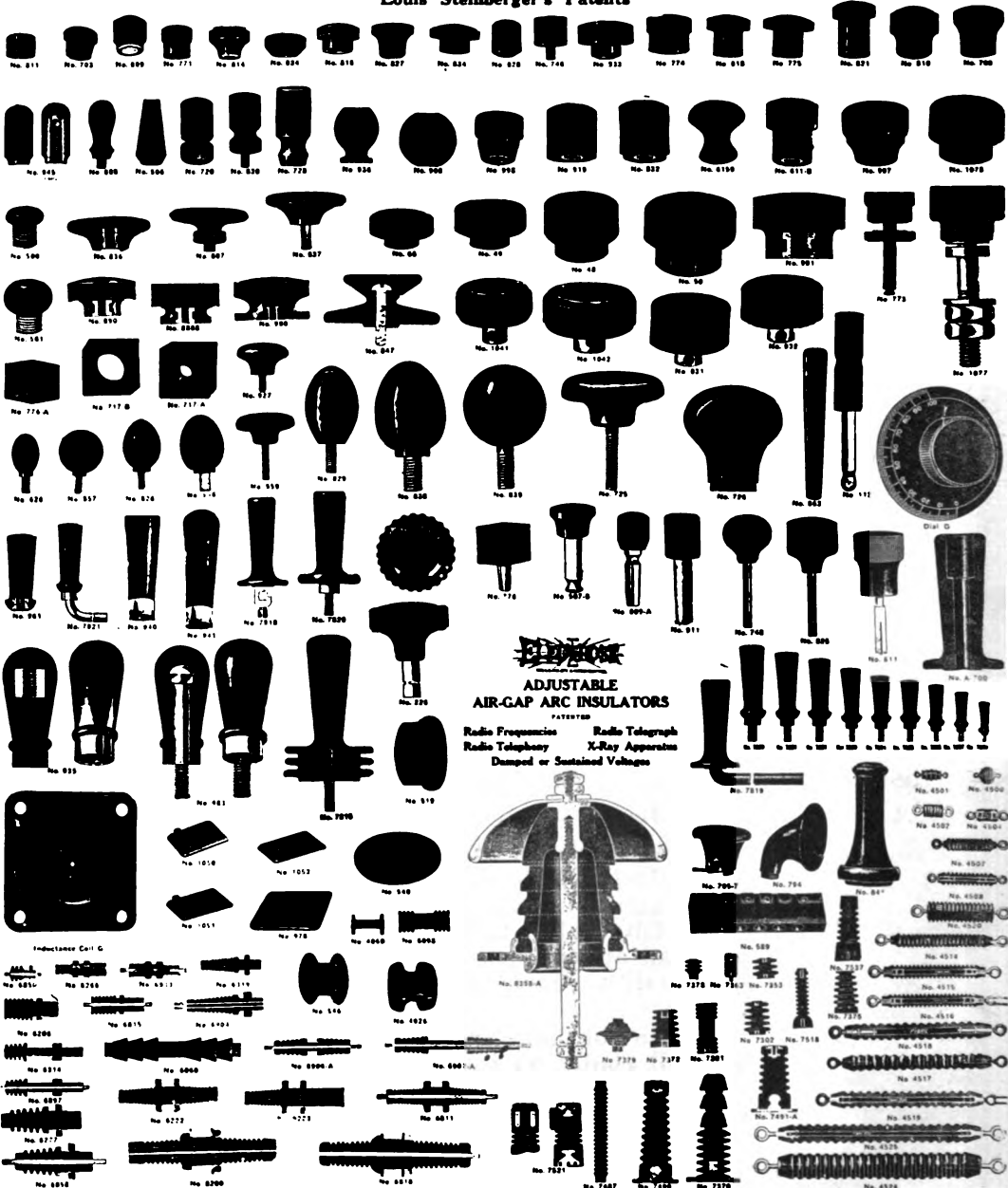


Medal and  
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Fair,  
St. Louis,  
1904



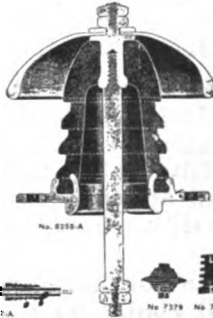
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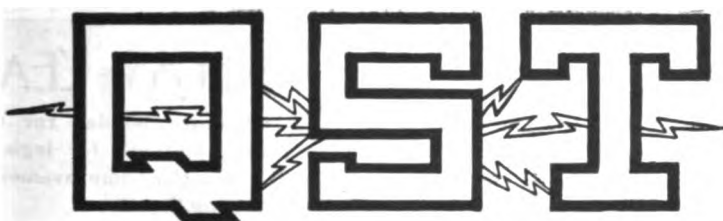
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# The Official Organ of the A.R.R.L.

VOLUME V.

MAY, 1922

No. 10

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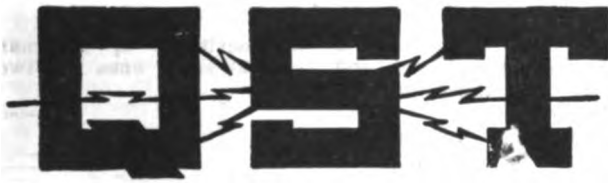
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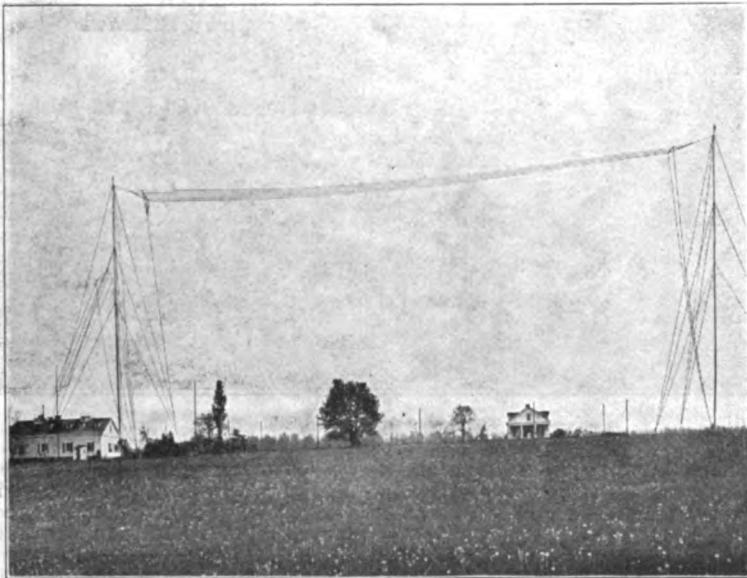
## ***3ZO---An Amateur Paradise***

**R**ADIATES there a ham with soul so dead who never to himself hath said—"Gee, if only I had the jack wouldn't I have a bird of a station!"

Such a station is that of Mr. Horace A. Beale, Jr., of Parkesburg, Pa., a director in our A.R.R.L. In fact Mr. Beale has three of them, 3ZO, 3XW and 3OI. This story, however, concerns itself chiefly with the main station, 3ZO. It almost ruins

running everywhere from single 5-watters up to sets using four 250-watt tubes? Say, how would you like to be turned loose in such a place for a week or so!

Just such a place Mr. Beale has built for himself at 3ZO. It is impossible to do this station justice in our limited space, and the photographs and descriptions herein can only hope to cover the high-lights of this remarkable station.



**The Aerial System at 3ZO**

us financially to pay for cuts of 1% of the good photographs available of 3ZO alone, so 3XW and 3OI are reserved for a future occasion.

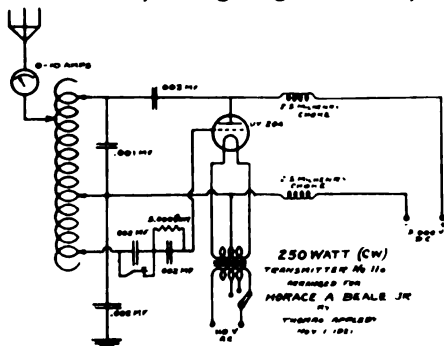
Say, fellow amateurs, can you imagine a station with a miniature Bureau of Standards for a "shack", a half dozen or so good masts, four or five operating rooms, ten receivers and twenty transmitters, the latter

First off, 3ZO has for its quarters the entire second story of a frame building, especially outfitted for the purpose. There is a main office and operating room, several small sound-proof operating rooms, a complete work-shop, a store room, a sleeping room, a kitchenette—everything. All the walls are lined with sheet zinc for shielding. An elaborate plug and jack system makes



effected on 375 meters with much better results than on the old slanting flat-top.

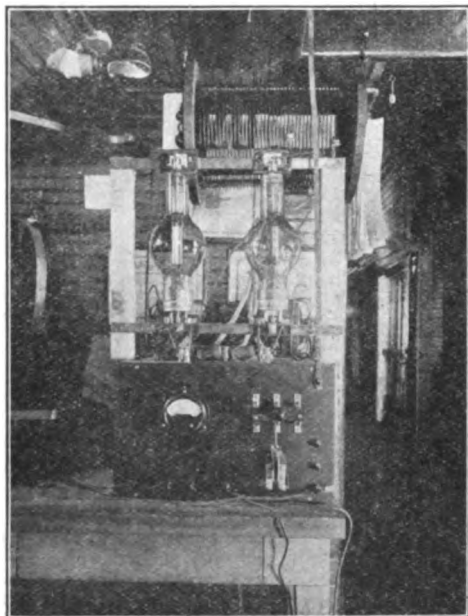
Besides a half-dozen or so DeForest phones and various home-made phones of small power, something like fifteen transmitters have been designed at 3ZO and most of them actually constructed. Not all of them, of course, are still in commission, and we don't even know what some of them were. No. 4 was the spark set as shown in one of our photographs, but this has now been junked and only C.W. is used. No. 5 is a phone using four 50-watt tubes, two as oscillators and two as modulators, which is the beautiful cabinet set with the slanting panel to be seen in the same photograph with the spark, and of which we present the wiring diagram. No. 8, behind the receiving set in the same photo, was a 375-meter telegraph set using four 50-watters in an A.C. self-rectifying circuit. Since the view was made this set has been replaced by No. 8-A, using a single 250-watt "P" tube, wiring diagram shown, also



self-rectifying A.C. No. 11-A is a similar set using one U.V.204 but on 3000 volts D.C., and its hook-up also is presented. No. 13, of which we have a photograph, is a beast employing two 250-watt U.V.204's on 375 meters, also self-rectifying. Then there's No. 14, a 200-meter transmitter

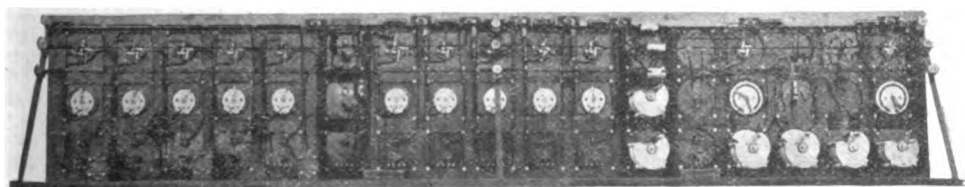
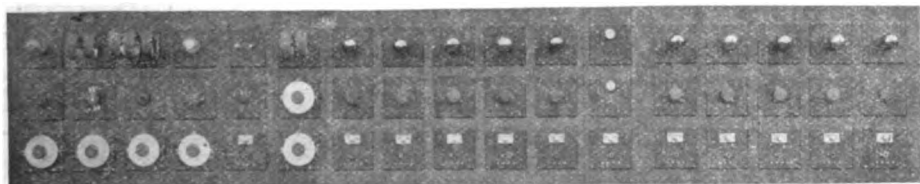
working on a small two-wire aerial we forgot to tell about, which uses two U.V.203's with A.C. on the plate. The diagram for this set is shown too.

No. 11, the pride of them all, is still in course of construction and considerable ex-



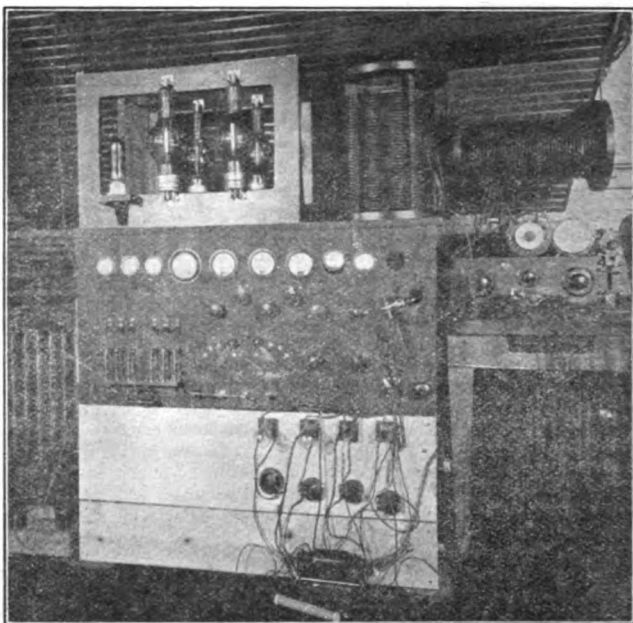
The No. 13 Transmitter

perimenting is being done with it to get all features correct before it is finally built up into a good job, as all of 3ZO's sets are. In the photograph, then, we see a temporary panel of boards on which the various meters and controls are mounted until the preliminary work is completed. This set has a main battery of four 250-watt tubes and is a phone, two of the tubes being



Front and rear views of the Superheterodyne

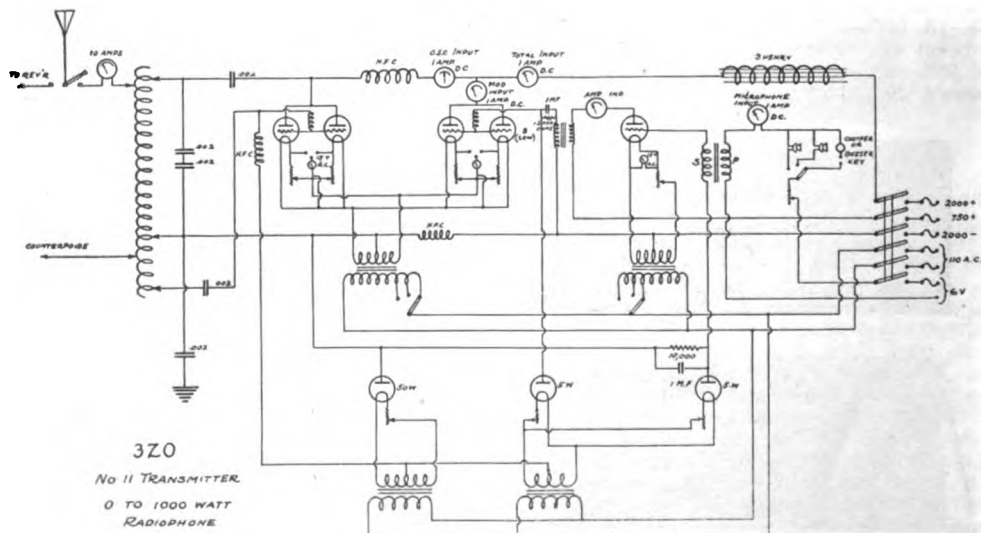
oscillators and two modulators. The 50-watt tube to the right of the big fellows is a speech amplifier. The secondary battery of tubes at the bottom have a most novel function, and the reader is referred to the connection diagram of this set for further details. (This is the way it was the last time we heard from Mr. Beale, but gawd nose what Tom Appleby's done to it by now.) In the hook-up three tubes are seen in the bottom portion—one a 50-watt and the other two 5-watters. In the No. 11 set great trouble was experienced with grid leaks and nothing that would satisfactorily leak the oscillator grids was found until a 50-watt tube was tried for this purpose. The connection from the grids runs to the filament of this tube, its plate completing the circuit to the grounded filaments of the oscillators. Then merely by adjusting the filament brilliancy of the 50-watt "leaker" and hence its electron emission, the resistance is varied and the leakage current controlled. It was found desirable to control the negative bias on the modulator grids and on the grid of the speech amplifier in the same manner (i.e., by a leaky condenser), and the two five watt tubes shown control respectively the modulators and the amplifier. Otherwise the circuit is conventional—a Hartley os-



The Big No. 11 Transmitter

cillator with constant-current modulation. In so elaborate a set the diagram of course looks complex with its various voltage supplies, chokes, filament transformers, etc., but if it is carefully studied it will be seen to be nothing more than the phone circuit with which most of us are already familiar.

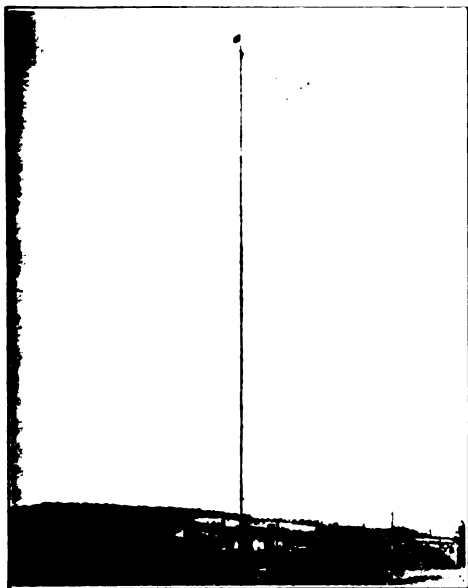
We almost overlooked the generator room. Of course it takes a young power-house to supply 3Z0. First there's a 17 k.w. D.C.





machine, giving 110 volt direct current for any desired purposes, and a small Crocker-Wheeler motor-generator unit giving 500 volts, neither of which show in our photo. At the other end of the room are two more machines. We forgot to ask what the one was against the distant wall, being lost in admiration for the beauty in the foreground. This is a special machine, of Eck make, rated at 1.5—2 k.w. at 3000 volts output. At the far end is the induction motor which drives it and at the near end is the separate excitor for the generators, while the latter, two in number, are in between all coupled in a row thru flexible couplings. It is a beautiful machine and incidentally attains full speed in two seconds.

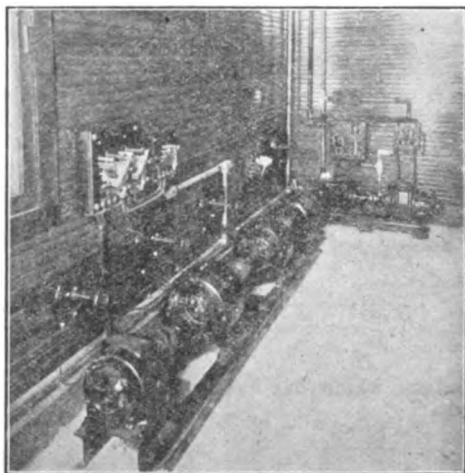
**In the line of receiving apparatus 3ZO**



**How'dya like to have a mast like this?**

is almost as well outfitted as it is in transmitters. There's a honeycomb set with built-in detector-three-step, a miscellany of outgrown sets, while the main dependence is put upon a Grebe CR-3 with Grebe companion tube equipment. In one of the smaller operating rooms where the No. 5 phone set is now located is an "Aeriola Senior" operating with two steps of audio amplification which Mr. Beale has built up using the new Westinghouse coated-filament tubes which are a standard part of the "Aeriola Senior", in conjunction with Acme transformers. In another room with the 200-meter C.W. set is a Westinghouse "RC" and likewise an Armstrong superheterodyne built up at the station. This is an immense set, stretching all the

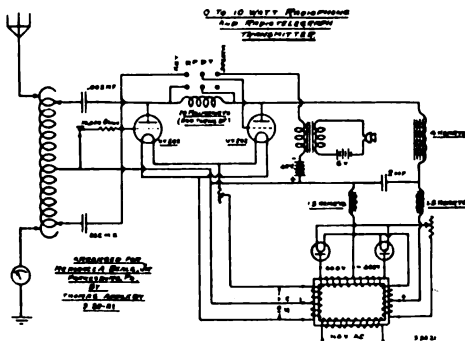
way across the room, and is composed of fifty-one DeForest "units". Referring to the photographs, three sets of honeycomb coils are to be noted. The first two are for



### A Corner of the Generator Room

the separate oscillator; the next group of three are for the first detector which by the way uses regeneration, whence the third coil; while the next pair couple on the radio-frequency amplifier of five stages. The last five tubes are audio amplifiers. No provision seems to have been made for a second detector in this set, nor does it appear in the wiring diagram we have, and this probably accounts for the rather unsatisfactory performance so far obtained from it.

Then there is 30I, a portable station consisting of a small special house mounted



on a 5-ton truck and sporting a neat little flat-top overhead. Inside the house is a roomy operating table, an oil stove, and a Delco gas-engine lighting outfit which also furnishes juice for sets from time to time installed therein. SOI is devoted primarily to



snitch, which I am told Kruse built down at the Bureau of Standards. Then by Heck, with the Uggerumph between my teeth and possibly with my Old Betsy going along with her wild-cat screech, just to give atmosphere to the occasion, I am going to run amuck among the broadcasters. There will be less and better broadcasting and the fear of God will be in the heart of every designer of a modulation transformer when I get through. By gravy, I have remained quiet for some time, after smashing in the slats of the Young Squirt and strewing his vitals over the landscape, but I'm not going to be meek and humble any longer. My dander has risen, I smell of burning insulation, and nothing but gore and wrecked radio telephone broadcast stations is going to satisfy me.

I don't blame Mr. Hoover for calling a Conference. I would have called somebody a worse name than that. It's high time some conferring was done. In fact, it's time somebody conferred a wallop upon somebody and got this mess straightened out.

Why Mr. Hoover overlooked me and my Old Betsy in this matter passes understanding. Between Old Betsy and me we would have saved a lot of valuable time, and report has it that Mr. Hoover believes in saving time. All that would have been necessary would have been for Mr. Hoover to advertise for every owner of a broadcast station to come to Washington and take his place in the line. Then I would have borrowed a respectable 220 volt, five horse induction motor from "LC" over at NSF and hooked her up to Old Betsy. As fast as Mr. Hoover had questioned the Broadcasters and satisfied himself as to their guilt, I would feed them feet first to Old Betsy. We could have turned the residue over to the garbage collectors to haul away. A couple of days would have done the job. The five horse motor might have to be wiped off before we returned it to "LC" and possible the Old Girl might need some cleaning up, but that would have only taken a few minutes. Think what a lot of trouble would have been sunk for keeps. The air of an evening would have returned to its old-time sweetness. The kids could go on with their Ford coils and their sticky vibrators and their horrible fists, and at ten o'clock we older birds could have come onto the air and handled traffic and have had all the old time thrills and have got enough and gone to bed by midnight. Oh Boy! And to think it used to be that way once!

But 'tis not to be any more. The Secretary of Commerce saw fit to have me and Old Betsy remain in the Eighth District, and instead of spitting on his fists and wading in, with my assistance, he preferred to call in the High Brows and allocate wave lengths and urge in polite language that radio apparatus, controlled lock stock and

barrel by a certain corporation, be freely available and at reasonable prices. That's the gentlemanly way to do it, I confess. But dod blast my suspenders if I believe it will clear up the air around three hundred and sixty meters nor get fifty watt tubes down to four ninety eight in the department stores. Gosh, but I wish he had consulted me in this matter. By Golly, you know boys, I believe I would have made a record on cleaning up that job.

Daggone that squawking soprano at KTPA! She certainly has yowled enough by this time. Gurrd, but why did she select that thing to sing! Sounds like a funeral dirge badly out of adjustment. I



"I would feed them feet first to Old Betsy"

wonder if the proprietors get samples of the goods before they accept them. Impossible! They certainly never would have put this squall out onto the air if they had heard it first. Some kind of inspection is needed. Zowie, she puts my teeth on edge! Oh dear, I wish I were dead! That female has catawalled now for a full fifteen minutes. Here Kitty, I need thee. Poor woman, I suppose somebody loves you. I'll bet a cooky you haven't an idea in the world what you are doing. Could any woman in her right mind yowl away like that if she realized a quarter of a million of her fellow countrymen were writhing in anguish and wishing to gawd she would hurry up and get it over with. Say, as I sit here smoking myself to death and cursing broadcasting and waiting for the time to come when I can tickle that old key, I can't help thinking of my sins and how different everything is in radio from what it used to be. It used to be that we had only ourselves to fight. It was all in the family then. But now the public are in the game. The dumb-bell with the hundred dollar receiver—the kind that knows no difference between 200 and 500 meters—is the one we must watch now. He wants SILENCE, and doggone little of that, and every time he hears any-

thing in the air except what he wants to hear, whether it is static or induction or a bubbly "B" battery, he froths at the mouth and writes his chum Senator Snigglefritz in Washington that the amateurs are spoiling this wonderful radio which is just beginning, and that a law ought to be passed at once shutting the amateur up. And by Heck, the old fat slob



"Final Authority has started up!"

firmly believes he is right. He really believes that Citizen Radio began with his buying a receiving set and learning how to get KDKA. He never heard of our A.R. R.L. He never has had a glimmer pass over his benighted intelligence that the amateurs ever did anything but annoy broadcast listeners. He is so sunk in black ignorance that he never heard of Paragon Paul Godley, nor 9ZN nor K. B. Warner, nor the Candles of St. Marys, nor the Transcons nor Fred Schnell, nor 4GL, nor by golly, T.O.M. He is a solid citizen and consequently he is a bad one to have fighting you. But some day the light of knowledge will bore through his dome and he will be around wanting to join the Radio Club and asking what's the best way to learn the code.

Listen—yes, the Pittsburgh Yowler has finished. Mr. Flannigan is now going to favor with a violin solo, with Miss O'Houlligan at the piano!! Lord help the poor suffering listeners to-night! Listen to that piano thump, and mind the vacant spots in the violin playing. This will most likely be another ten-minute bout. And all this perfectly good battery juice going to waste. I wonder why I don't kick this junk into the river and take up auction bridge? Gee, but I wish I were dead!

Ohmy gawd Final Authority has started up! That's his fone. I know the sixty cycle hum. Now listen to him count and whistle "Rock of Ages". He's off. His voice sounds as though he were inside a tin

cracker box. Listen to her wheeze. Blots out everything from the bottom of the scale on my tuner up to the top of the long wave coil. Ye gods and little fishes! I simply cannot endure it. Let's put out the bulbs and write a bit to kill time.—Stand still a minute, Kitty.

My next door neighbor has it in for Final Authority. Somehow he found out who was responsible for the big noise in the air and he asked me the other night whether something couldn't be done about him. I remember the occasion when Final got in wrong with my neighbor and it is worth telling, while we wait for the broadcast bull to spend itself. It seems that Final had arranged a coup, as the say in La Belle France. He had copped the big singers at the concert that came to town and after their part of the programme was finished, Final hustled them out to his house and got them to sing into his phone. He had just secured his limited commercial broadcasting license and he thought he was some hot stuff. Some how or other, his phone worked well that night and I will have to confess the singing was pretty good. It woke up the little wife at our house and she paid attention for the first time. She considers most radio phone music as not worth spitting on.

It so happened that on that same night my neighbor decided to give a little phone party at his house. He told me his guests arrived and they waited for KDKA, Detroit



"Wait until the dumb-bells get poisoned with these little dit-dit's"

and Washington and had just heard the "Detroit News" tell something they were going to do, when—crash—bang—Final Authority came rattling the diaphragms with his special concert. Detroit was blanketed, as was everything else. The guests thought it was Detroit and were thrilled to the marrow bones. But Neighbor Jones had to let the cat out of the bag, and he said that when they found that it was only coming from their own town they lost all interest. They wanted to hear De-

troit. The rottenest jazz from Detroit would have been ten times more interesting than the finest stuff the world afforded from their own town. They wanted the thrill of long distance, and I had to smile as I thought of what we amateurs have been through all the past years. The thing that has held us together and kept the interest up year after year has been just this very selfsame long distance stuff. Daggone if I don't believe it's going to be the same with these dumb-bells. They are going to get fed up with the near-by stuff and the concerts and the speeches giving detail specifications as to how to peel potatoes, and one by one they are going to begin wondering about the little chirps and the little buzzings down on two hundred. By and by some of them will get to know the numerals when they hear them, and then they will borrow a call book somewhere, and when they get so they can catch the district the signal is coming from, it will be all off for the cheap broadcast stuff. They will either slough off completely and sell their sets or will get the bug and become amateurs.

That's my guess and I'm not far wrong, for I see the rash breaking out on Neighbor Jones already. Say, isn't it funny, how those little dots and dashes get you? DAH-DAH-DAH-DAH—DIT. DIT-DIT-DIT-DIT-DIT. DIT-DAH-DAH-DAH-DAH. DAH-DAH-DAH-DIT-DIT. Those two quick little DIT-DIT's on the end mean the good old EIGHTH DISTRICT, and I suppose every fellow has the same home feeling about his own district. Wait till the dumb bells get poisoned with these little DIT-DIT's and it will be all off with the broadcast concerts and the lectures on potato peeling.

Well, it's ten thirty, boys, and there is old 1AW calling 3ALN and telling him "msgs", and his fist sounds like it might be the Old Chief at the key. Gosh, but it sounds good. Guess I better oil up the Old Girl and get in myself. Seems like a good night and we ought to clear the old pin off by the looks.

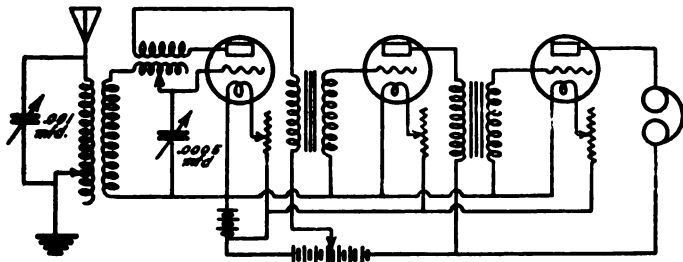
Well, old timers, 73 to all of you, and by Heck let's hold fast to our good old dot and dash stuff. GN SK

## An Efficient Tuner for Short Waves

By H. J. Goddard, 9ZX, 9EE

THE short wave tuner described in the following article is offered to the amateur, not as a substitute for an expensive variometer set, but rather as a tuner, easily and cheaply constructed, that will prove nearly if not entirely as efficient as the best standard receivers on the market today. Its range is approximately from 180 to 600 meters, it oscillates freely over the entire wavelength range, and functions equally well

scribed to the writer by Mr. H. J. Burhop, 9ZL, this tuner was designed, so far as I know, by Mr. Melvin Herman, 9FN, and to both of these men I am indebted for the constructional data. I would not go so far as to say that this tuner is better than the variometer set in question; but I do say that in my case at least, it has proven only slightly less sensitive than the variometer set and considerably more selective.

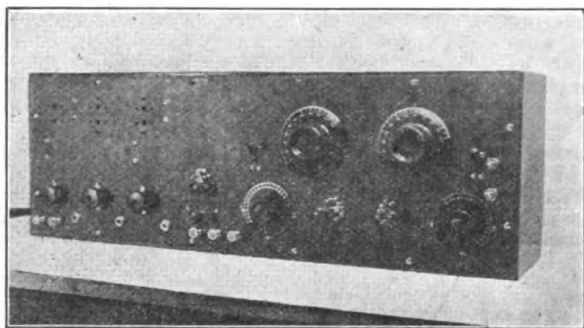


for spark, C.W. or phone reception giving wonderful amplification of all signals. It belongs to the tickler type of receiver and uses single-layer coils as inductances. It has been pointed out to the writer that its dead-end losses and the use of capacities are detrimental to efficiency; but, be this as it may, the amateur who constructs one of these tuners is very likely to do as have several others who have tried it—discard his variometer set. Originally de-

Briefly, the tuner consists of four coils. These coils may be wound upon cardboard tubes if desired but bakelite or formica tubing on account of its greater strength and permanence is to be preferred. Two of these tubes are 5 inches inside diameter and two are 4½ inches inside diameter. All four are 1½ inches in length (or width). Upon one of the 5 inch tubes is wound 24 turns of No. 26 DCC wire tapped every 6 turns (4 taps). This is the primary wind-

ing. The other 5 inch tube is made up exactly the same as the first and constitutes one half of the secondary winding. Upon one of the smaller tubes wind 24 turns of No. 26 DCC, but taking off no taps; this is the second half of the secondary winding. The remaining small tube is wound with 36 turns of No. 26 DCC, no taps. This is the tickler winding. The direction of winding is immaterial, but all windings may well be in the same direction.

The untapped portion of the secondary



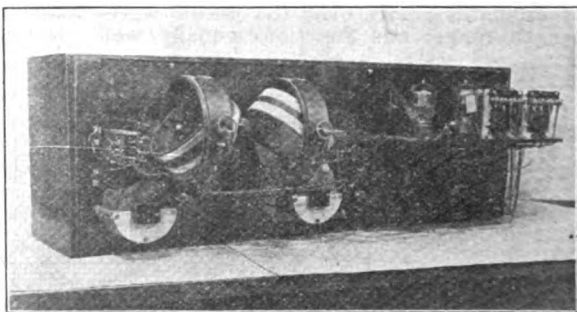
is now mounted upon shafts so that it will rotate within the primary winding. In like manner, the tickler winding is mounted to rotate within the tapped portion of the secondary. We now have what amounts to two variocouplers. These are mounted upon the panel, the two portions of the secondary connected in series and the primary and secondary taps brought out to switches upon the panel. The ends of the tickler winding are connected to the plate and phones as usual; the terminals of the secondary are attached to the grid and filament, and the primary connected to the aerial and ground. A 43-plate variable condenser is connected through a switch so that it may be placed either in series or shunt with the primary and a similar condenser, but of 23-plate size, is arranged so that it may be either shunted across the secondary or cut out altogether. The writer recommends that condensers equipped with verniers be used since the set tunes very sharply.

#### Suggestions on Operation

To a person unaccustomed to this tuner, it is likely to be disappointing at first. Its selectivity is such that it may be discarded before it is given a fair trial. It is usually best to bring the tickler control nearly to the oscillating point at the outset then varying the primary and secondary controls until the signal is heard, then reducing re-

generation slightly until the adjustment of the primary and secondary are completed and the signal strength is the greatest that can be obtained without oscillation. In general, let the inductance predominate. If now the tickler control is manipulated the signals will come in greatly amplified. This tickler control, however, is very critical and a change of even one degree on the scale will make a world of difference.

It will be noted from the accompanying photographs of the writer's set that the condensers are mounted upon the lower portion of the panel. This disposition of the condensers places them where they may be controlled with the arm resting upon the operating table being especially valuable in following a swinging signal which can usually be done by varying the vernier of the secondary condenser without touching the other controls. It might be pointed out that the writer's set is built left-handed; in other words the condenser and switch at the right control the primary while those on the left control the secondary. This left-handed feature is carried throughout the entire set, the right hand tube being the detector, and successive stages of amplification being disposed at the left of the detector. This places the most frequently used controls nearer the body and in the most convenient position relative to the transmitting key. It will be found advantageous to shield the panel, at least in front of the tuner proper, either with tinfoil or copper sheets, these being



grounded. Shielding of some sort is almost a necessity; but the writer finds that shielding of the secondary condenser alone answers very well.

In conclusion the writer wishes to say that he will be very glad to answer any questions regarding the construction or operation of this tuner that may occur to the prospective builder.

## The Governors-President Relay

By K. B. Warner

**A**MATEUR radio again demonstrated its capabilities, and at a most opportune time in the legislative situation, in our A.R.R.L. Governors-President Relay on March 6th, 7th and 8th when messages to President Harding were received and delivered at the White House from forty of the forty-eight states. Messages failed to start from five of the remaining states, while three started but failed for one reason or another to reach Washington. Considering the bad weather that prevailed during much of the tests, that is a splendid performance and again we have the consciousness of a hard job well done.

### The Scheme

As announced in an earlier QST, the preliminary arrangements were very simple. Our Operating Department prepared a schedule of starting times and the Division Managers were asked to solicit or arrange for the securing of a message to the President from the Governor of each state in their respective Divisions. No hard and fast rules applied in this relay and the work was individual in each state, making real co-operation count. There was no fixed plan for handling the messages, no predetermined routes; they were to move on each of the three nights as opportunity afforded, in all the flexibility of routine relaying. The plan was remarkable in its success and we amateurs showed again that we are what one of the Governors called us: "Minute Men of radio".

### The Receiving Machinery

The Washington end was beautifully organized by the Washington Radio Club under the administration of its president, H. A. Snow, 3ZE. At a club meeting two nights before the tests the plans were completed and 3IL, Strang, the club's chief operator, selected as a concentrating station for the delivery of the messages; 3IL and 3ZE as control stations, and 3ZY and 3ALN as the operating stations to work with outside stations who had the messages. Both 3ZY and 3ALN are C.W. and do not interfere with each other. 3ZY was manned by its owner, L. M. Dunnam, and H. J. Wadsworth of 3JJ, while the operators at 3ALN were its owner, H. F. Hastings, and Snow of 3ZE. A perfectly working machine was the result and but one case of avoidable interference marred the performance.

On the first night, March 6th, the atmospherics were awful and logs from all over the country show that operating conditions were generally rotten thruout the land. Nevertheless 8 messages got thru these

almost impossible conditions, one direct from a state capital in the form of Connecticut's message which was picked up from 1AW by 3ZE, while 7 others came in by various routes. On the second night static was still bad at 10 p.m. but practically nil after midnight, and messages from 15 additional states were received besides a second receipt of many of the previous night. On the night of the 8-9th the air was very good and a total of 17 more states were corralled, making 40 in all. With 5 not starting and 3 failing to arrive we account for our 48 states. During this



last night as time grew short the gang automatically QSK's messages they knew were safe in Washington the preceding nights, relieving the air of this extra traffic, and all hands concentrated in an effort to locate the missing messages.

3ZY was the star of the Washington team with credit for 27 messages received, while 3ALN got 12; and one, Connecticut's, was received direct by 3IL and 3ZE. Out-of-town honors in the eastern states where the messages were concentrating go to 9ZJ, 4GL, 8AXY and 3ZO.

### Delivery of the Messages

A little unfortunately for us, right in the midst of the relays the President left Washington for a short vacation in Florida and was out of the city upon the conclusion of the tests. The messages were delivered at the White House on the 9th by the Washington Radio Club, accompanying the following letter, but had to await his return to the city.

2020 First S., N. W.,  
Washington, D. C.  
March 9, 1922

Sir:

The attached forty messages from Governors and State officials have been handled entirely by amateur radio operators who are members of the



American Radio Relay League. They are the result of a three days relay known as the "Governors'-President Relay" which was instituted and operated under the supervision of the League. The traffic was handled on the nights of March 6, 7 and 8 in accordance with the plan of operation mapped out by the Traffic Manager. Reception at Washington was effected by two stations of members of the Washington Radio Club which is affiliated with the American Radio Relay League.

The members of the League are always at your command and are willing to do anything in their power to further the interests of their country.

Very respectfully,  
(signed) Harry L. Strang,

The President, Chief Operator,  
The White House Washington Radio Club

Upon his return the President acknowledged the messages with the following letter:

The White House,  
Washington,  
March 21, 1922

Mr. Dear Mr. Strang:

Returning from his brief southern trip, the President finds the radiograms of greeting from the Governors of States, which were gathered thru the interest and activity of the American Radio Relay League, and forwarded to him.

Availing himself of the courtesy extended by you, he will be glad if your organization will convey to the Governors his appreciations and thanks for their kindly expressions. He wishes me also to thank all the members of your organization who have participated in bringing to him this remarkable greeting.

Very sincerely,  
(signed) Geo. B. Christian, Jr.,  
Secretary to the President.

### The Messages

The messages are so interesting that we publish their full text below. We sincerely wish it were possible to give the complete routing of each message but logs are insufficient on some, the fact that some messages were duplicated on successive nights makes it impossible to identify the route of any given night's message, some moved by several routes, and in many cases they were copied out of the air by eastern stations and plunked into Washington ahead of their routine appearance. We will give with each message a list of stations known to have participated in its handling on some one of the three nights as gathered by an inspection of logs at hand, but wish it understood that the lists are not complete and in no sense accurately portray the route over which the respective message moved.

**ALABAMA**—Montgomery, Mar. 8.—His Excellency, Warren G. Harding, Washington, D. C.—Congratulations on reserve of radio minute men for national emergencies.—Thomas E. Kilby, Governor of Alabama. Moved 5XA to 4GL to 3ZY.

**ARIZONA**—Phoenix, Mar. 7.—Hon. Warren G. Harding, President, United States, Washington, D. C.—Congratulations on the magnificent heights of your first years administration.—Thomas C. Campbell, Governor of Arizona. Some real participation in this one: 6AAH, 6ZZ, 5IF, 9DSD, 9ACB, 90X, 8BBU, 8YN, 8VY, 8AGO, 8AXY, 8ALN, 8ZU, 4GL, 9KO, 9BED, 9DMJ, 8AGZ, 4ZC, 3ZY.

**ARKANSAS**—Little Rock, Mar. 8.—President Harding, Washington, D. C.—Greetings and felicitations on prospect of freeing ourselves of shackles of miles and slow delivery.—Thomas C. McRae, Governor of Arkansas. Known to have passed thru 5JD, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 8BBU, 8AXY, 8ALN.

**CALIFORNIA**—Sacramento, Mar. 8.—President Harding, White House, Washington, D. C.—California sends heartiest greetings and best wishes to you and Mrs. Harding.—William D. Stephens, Governor of California. Credited to 6GF, 7MF, 6ZX, 6ZAM, 9AVZ, 5ZA, 9DZJ, 9ZJ, 3ZY.

**CONNECTICUT**—Hartford, Mar. 6.—President Harding, Washington, D. C.—Connecticut congratulates you upon your assured success of national conference so ably led by you.—Everett J. Lake, Governor of Connecticut. 1AW to 3ZE.

**DELAWARE**—Dover, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—Greetings and best wishes from the state of Delaware.—William D. Denney, Governor of Delaware. 3ZO and 3ZY.

**FLORIDA**—Tallahassee, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—The people approve your efforts to promote world peace. Congratulations.—Cary Hardee, Governor of Florida. 4II to 3ALN, direct.



**GEORGIA**—Atlanta, Mar. 6.—President Harding, Washington, D. C.—Greetings to President and Mrs. Harding from Governor and Mrs. Hardwick.—Governor and Mrs. Hardwick. Handled by 4AU, 8AJD, 8BDB, 8ARN, 4FT and 3ZY.

**IDAHO**—Boise, Mar. 7.—President Harding, Washington, D. C.—Cordial greetings from the state of Idaho.—D. W. Davis, Governor of Idaho. Early routing unknown; 9YAE to 9ZJ to 3ZY.

**ILLINOIS**—Springfield, Mar. 8.—President Warren G. Harding, Washington, D. C.—Accept Illinois greetings and heartfelt thanks for your efforts to insure world wide peace.—Len Small, Governor of Illinois. Direct 9ASL to 4BY to 3ZY.

**INDIANA**—Indianapolis, March 7.—President Harding, Washington, D. C.—Greetings from Indiana to the honored President of the United States. Congratulations on the splendid accomplishments your first year.—Governor McCray of Indiana. 9ZJ to 3ZY.

**IOWA**—Des Moines, Mar. 7.—President Warren G. Harding, The White House, Washington, D. C.—Accept the salutations of the State—Iowa wishes you all happiness.—N. E. Kendall, Governor of Iowa. Passed thru 9DEH, 9AFW, 9AAW, 8WD, 2FP, 3ZY.

**KANSAS**—Topeka, Mar. 7.—President Warren G. Harding, Washington, D. C.—Kansas sends cordial greetings and felicitations.—Henry J. Allen, Governor of Kansas. Try to figure this out: 9RV, 5MZ, 9DZQ, 8AQR, 6QI, 5XU, 9HI, 9DTA, 9DZQ, 9IF, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 8ZO, 3ZY.

**KENTUCKY**—Frankfort, Mar. 7.—President Harding, Washington, D. C.—I am happy to send you the greetings of your thousands of friends in Kentucky.—Edwin P. Morrow, Governor of Kentucky. 9IO, 9EI, 90X, 9AAW, 8BBU, 4GL, 3ZY.

**LOUISIANA**—Baton Rouge, Mar. 7.—Hon. Warren G. Harding, Washington, D. C.—American soil and American genius are the cornerstones of American greatness.—John M. Parker, Governor of Louisiana. 5AA, 5JD, 5XU, 9ZJ, 8ZY, 6ZU, 4GL,



SABA, 8AOI, 9AGR, 8FT, 8AJV, 8AJX; but also direct 5LA to 3ZY.

MAINE—Augusta, Mar. 8.—Warren G. Harding, President, White House, Washington, D. C.—I congratulate you upon your first years administration and send you and Mrs. Harding greetings from the state of Maine.—Percival Baxter. 1APO, 1BHJ, 1BRQ, 1ARY, 8FM, 8ZO, 8ZY.

MARYLAND—Annapolis, Mar. 6.—President Harding, White House, Washington, D. C.—The Governor and people of Maryland send their greetings and best wishes to President Harding.—Governor Albert C. Ritchie. 8AJD to 8ALN.

MASSACHUSETTS—Boston, Mar. 6.—Warren G. Harding, President United States, White House, Washington, D. C.—Cordial greetings from Massachusetts which remains steadfast in support of your earnest and successful efforts to establish peace in the world and better conditions at home.—Governor Channing C. Cox. 1XM, 1ZE, 1COA, 1SN, 1OM, 2BEA, 3ZY.

MICHIGAN—Lansing, Mar. 8.—Warren G. Harding, President United States, Washington, D. C.—I take the opportunity afforded to me by amateur radio operators of the country of sending to you my heartiest greetings and well wishes.—Alex J. Groesbeck, Governor of Michigan. 8ZF, 8ZZ, 8BO, 4GL, 8ZY.

MINNESOTA—Minneapolis, Mar. 8.—President Harding, Washington, D. C.—The state of Minnesota greatly interested in development of radio and appreciates all that you and your administration are doing in its behalf.—J. A. O. Prou, Governor of Minnesota. 9XI, 9ZJ, 3ZY, 9YAE.

MISSOURI—Jefferson City, Mar. 6.—Hon. Warren G. Harding, President, Washington, D. C.—Through our Missouri marketing bureau broadcasting station I salute you by wireless.—Arthur M. Hyde, Governor of Missouri. 9ACB, 9ARQ, 9ZB, 8XU, 9YM, 9ZJ, 8ZY.

MONTANA—Helena, Mar. 7.—President Harding, White House, Washington, D. C.—Montana is confident of her future under your administration—Montana sends greetings.—Story, Lieutenant Governor. 7XB, 7ZU, 7LY, 9AVZ, 9HI, 9DMJ, 8WI, 8AXY, 8ALN; also 9YAE to 9ZJ to 3ZY; also 9WU to 8BO to 4GL to 3ZY.



NEBRASKA—Lincoln, Mar. 8.—President Warren G. Harding, Washington, D. C.—Sincere good wishes for success in problems that confront you.—F. A. McCoove (instead of Gov. McKelvie.) 9AGR, 8AOI, 8FT, 8AJV, 8AJX, 8BBU, 8AXY to 8ALN.

NEVADA—Reno, Mar. 8.—President Warren G. Harding, Washington, D. C.—Greetings from Nevada transmitted by the nation's brightest boys and girls.—Emmett D. Boyle, Governor of Nevada. 6QR, 6AAH, 6QR, 7LY, 7ZU, 9AVZ, 9WI, 9DEH, 9AAW, 8EB, 9YAE, 9ZJ, 4GL to 3ZY.

NEW HAMPSHIRE—Concord, Mar. 7.—Warren G. Harding, President United States, Washington, D. C.—For peace and the hope that it inspires New Hampshire is profoundly grateful.—Albert O. Brown, Governor of New Hampshire. 1BAE, 1ADL, 1XM, 1ADT, 2TS, 3ZO, 3ZY, 8XE, 1AW to 8A.

NEW JERSEY—Trenton, Mar. 7.—President Harding, Washington, D. C.—I welcome the opportunity to extend greetings by the latest demonstration of the genius of our youth—the wireless.—Governor Edwards. 3ZO to 3ZY.

NORTH DAKOTA—Bismark, Mar. 8.—President Harding, Washington, D. C.—North Dakota con-

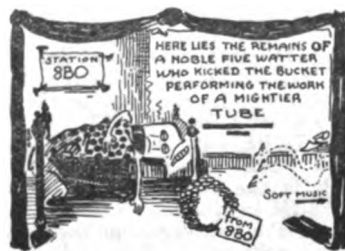
gratulates you on your stand on the Great Lakes to St. Lawrence tidewater route believing the completion of such a project will materially aid in the development of this great northwestern country.

—R. A. Nootes, Governor of North Dakota. 9FX, 9WU, 8BO, 4GL, 3ZY.

OHIO—Columbus, Mar. 7.—Warren G. Harding, President of the United States, Washington, D. C.—Benefit of wireless such as to warrant every possible encouragement.—Governor H. L. Davis. 8BBU 8AXY to 8ALN.

OKLAHOMA—Oklahoma City, Mar. 7.—President Harding, Washington, D. C.—May your efforts to limit armaments be successful.—J. B. A. Robertson, Governor of Oklahoma. 5HK, 9DMJ, 8ARD, 9CS, 9AAW, 9WI, 8WD, 2FP to 3ZY.

OREGON—Salem, Mar. 8.—President Harding, Washington, D. C.—Boys of the Radio Association of Salem, Ore., branch of the A.R.R.L. ask me to convey greetings for them to you by radio and extend to your their most sincere compliments and good wishes.—Ben W. Olcott. 7MP, 6AGF, 9IF, 9DTA, 8XU, 9ZJ, 3ZY.



PENNSYLVANIA—Harrisburg, Mar. 7.—Warren G. Harding, President, White House, Washington, D. C.—My dear Mr. President—It gives me pleasure to extend to the President of the United States the greetings of nine million loyal and patriotic Pennsylvanians—I am pleased indeed to assist amateur radio operators in their efforts to popularize this very important system of telegraphy.—Cordially yours.—William C. Sproul, Governor of Penn. This "book" via 8AGT, 8AQR, 8AAY, 8ZO and 8ZY.

RHODE ISLAND—Providence, Mar. 6.—Hon. Warren G. Harding, Washington, D. C.—Heartly congratulations and best wishes for future.—Emory J. SanSouci, Governor of the state of Rhode Island. Only record 8AJD to 8ALN.

SOUTH DAKOTA—Pierre, Mar. 8.—President Harding, White House, Washington, D. C.—Appreciating value of wireless and interested in A.R.R.L. South Dakota sending greetings.—W. H. McMaster, Governor of South Dakota. 9DEH, 9AAW, 8EB, 7LY, 7XB, 5HK, 9DMJ, 9WI, 9DSD, 9AVZ, 9FL, 8AXY to 8ALN.

TENNESSEE—Nashville, Mar. 8.—President Warren G. Harding, White House, Washington, D. C.—No better service to the country could be performed by Congress and your administration than to authorize the completion of the Muscle Shoals project and the acceptance of Ford's offer to lease it.—A. A. Taylor, Governor of Tennessee. 5FV, 8SP, 8ALN.

TEXAS—Austin, Mar. 7.—President Harding, Washington, D. C.—The federal prohibition law permitting federal judge to assess light punishment for violation of that law encourages those criminally inclined to become professional bootleggers.—Pat M. Neff, Governor of Texas. 8ZU, 4GL, 9YAE, 9ZJ to 3ZY.

UTAH—Salt Lake City, Mar. 8.—President Harding, Washington, D. C.—Best wishes for the success of the national rally.—Chas. P. Mabey, Governor of Utah. 6ZAJ, 6SJ, 6AFD, 9XAG, 9APN, 9YAE, 9ZJ to 3ZY.

VERMONT—The President of the United States, Washington, D. C.—Greetings and best wishes from the Green Mountain State.—James Hartness. 1ARY, 2AB, 8FM, 1XM, 8ZO, 8ALN, 8ZY.

VIRGINIA—Richmond, Mar. 7.—President Warren G. Harding, Washington, D. C.—May I take

advantage of this opportunity to send you greetings on behalf of the Old Dominion?—E. Lee Trinkle, Governor of Virginia. 3BLF, 3ZY.

WASHINGTON, Olympia, Mar. 8.—President Harding, Washington, D. C.—Congratulations on a successful year.—Louis F. Hart, Governor of Washington. 7ZP, 7BC, 7BK, 7VZ, 7HI, 7XB, 9YAE, 9ZJ, 3ZY.

WEST VIRGINIA—Charleston, Mar. 6.—Pres. Warren G. Harding, White House, Washington, D. C.—West Virginia sends greetings by radio to President Harding.—E. F. Morgan. 8SP to 3ZY.

### The Messages That Didn't Arrive

Some of the governors were out of town, some ill and some too busy, and three messages got hung up en route, so that eight states were not heard from in Washington:

COLORADO—None of the logs received report anything on this message and it is believed that it never started.

MISSISSIPPI—Didn't start on Mar. 6th or 7th but left 5YE at 11:15 p.m. C.S.T. on the 8th and apparently got stalled in the Ninth District until too late.

NEW MEXICO—No message furnished by the governor in response to the District Superintendent's request.

NEW YORK—It is difficult to believe that New York's message could have failed but such is the case. It left Albany via 2PV, to 2BM in Hudson, N. Y., who gave it to 2DA in Poughkeepsie on the last night. The latter acknowledged it and endeavored to QSR but finding it impossible to raise anyone thru the QRM, and knowing it was the last night, endeavored to QSK it back to 2BM. We must record that the message was stuck at 2DA.

NO. CAROLINA—The governor declined to take part and no message was started.

SO. CAROLINA—No message started.

WISCONSIN—Instructions to District Superintendent miscarried and no message was secured from the governor.

WYOMING—Message left 7ZO on the 7th to 9WI, who gave it to 9DMN. Later it was recorded at 9AZA in Wisconsin, who was heard late on the last night making valiant efforts to unload it on somebody east but to no avail, and it died there, to the best of our records.

### Gleaned From Logs

That Arizona message must have been greased. It went thru to the east every night with precision. On one night for example we definitely disclose its relaying thru five stations in an elapsed time of 13 minutes. That's real relaying! Not only did the Arizona fellows see their message moving nicely by "short" jumps but on the last night 6ZZ on his C.W. gave it direct to 8AGZ in E. Cleveland, whom he works regularly, a distance of 2000 miles. The latter couldn't raise anyone in Washington, however, and in desperation gave it to 4ZC in Florida, who QSR'd.

A few of the routes traversed were ludicrous. For instance the New Hampshire went to 1XM on the first night but apparently died there and on the second

night 1ADL gave it to 8XE in Pennsylvania as the only DX he could raise. The latter heard 1AW working Washington and so passed it back to New England, making the perfectly wonderful routing 1ADL-8XE-1AW-3ALN. Sounds more like tennis.

9ZJ, Indianapolis, has the distinction of being the station putting the largest number of messages into Washington for their first official receipt there. His log is interesting:

"Mar. 7-8. 11:17 p.m. Mo. msg. recd fm 9YM. 11:33 p.m. Texas msg. from 9YAE. From 1:20 to 1:25 a.m. worked 3ZY, giving him Mo., Tex. and Ind. msga. 1:41 a.m. Idaho messages from 9YAE. Gave this to 3ZY at 2:02 a.m.

"Mar. 8-9. Fine night. 11:06 p.m. Washington msg. from 9YAE. 12:20 a.m. Minn. msg. from 9YAE. 12:30 a.m. Mo. msg. from 5XU. 12:32 a.m. Minn. msg. again from 9XI. 12:34 a.m. Ore. msg. from 5XU. 12:38 La. msg. from 5XU. 1:14 a.m. Utah's from 9YAE. From 1:45 to 2:10 a.m. worked 3ZY, giving him Utah, La., Ore., Minn., Mo., Wash., and Ind. msga. 2:18 a.m. Nevada's de 9YAE. 2:35 a.m. Calif.'s from 5ZA. Gave Cal. and Nev. msga. to 3ZY at 2:50 a.m. 3:02 Mont. msg. from 9YAE; gave this to 3ZY at 3:14 a.m." (All figures in Eastern Time.)



9YAE did great work in the northwest country, handling the messages from Texas, Idaho, Washington, Minnesota, Utah, Montana and Nevada—all passed to 9ZJ.

8BO with a single 5-watt tube covered some remarkable distances, handling the Montana and North Dakota messages from 9WU in Ellendale, N.D., and the Michigan message from 8ZZ. On the 8th, calling 3ZY, 4GL replied with a "Shoot" so he stepped on 'er and 4GL QSL'd for 1, 2, 3 in his w.k. style. 8BO had barely given his "tnx nil nw" when the only 5-watter on the premises gave a sigh and turned over dead. It was a great end for a good tube and 8BO thanks his Lady Luck it held out until he QSR'd. Some distances for real relaying on one tube.

Another remarkable bit of C.W. work

was that of 5LA, New Orleans. 5ABA in Baton Rouge, securer of the message, phoned it to 5LA as his set was "out". 5ZAB, the starter, failed to start the message and 5LA as substitute dumped it right into 3ZY at 10:35 p.m. on the 7th and again on the next day he did the same thing at 10:09 p.m. 5LA uses three 5-watters with 1.9 amps. in the aerial.

1SN had a rotten time with the Massachusetts message on the second night. All evening long he tried to raise somebody who could copy him but no soap until 1:36 a.m. when finally he got a GA from 2OM. After resending some jammed parts he got an OK at 2 a.m. and his log shows his relief: "The rep of Mass. is saved—by 2OM, hero!"

5ZU got the Texas, Louisiana and Arizona messages and, hearing 4GL cranking that Ford of his, dropped them on him at 30 per and got the usual "OK 1, 2, 3". Three minutes later he had the satisfaction of hearing his messages going north from 4GL. Hill did good work, a batch of the messages passing thru his station.

That Utah message could tell a rotten story. 6ZAJ started it to 7MP on the 6th and was about half way thru it when the power went off. The trouble wasn't located for several days, when it was discovered that a neighbor had cut one of his distant-control wires to stop the lights flickering. What an opportune time! Meanwhile 6ZAJ phoned the message to 6SJ in Salt Lake but the latter blew his condenser when he tackled the job and had to phone it to 6AFD. Finally it got started via radio at 10:20 Mountain Time on the 7th, 6AFD to 9XAQ to 9APN, and reached Washington OK on the last night.

3ZO relayed the Penn., New Jersey, Delaware, Kansas, Vermont, New Hampshire and Maine messages. At 1 a.m. on the 9th he learned that the messages from Maine and New York had not yet reached Washington and made special efforts to pick them up. The New York one never was found but the Maine one was got from 3FM at 2:15 a.m. and given to 3ZY at 2:34. It didn't leave Maine until the last night, suffering various delays in local stations before it left the state.

9AVZ of Pierre, S.D., pulled a good one. On the second night he had the Nevada message safe on his pin and—but let his log tell the story:

"12:05 a.m. Went to bed and set alarm for 2 a.m.

"7:05 a.m. Woke up. Didn't hear alarm at 2 o'clock. And Nevada message still on the hook! Called CQ but nobody on."

But he got it off OK that night to 9WI!

#### Acknowledgments

The greatest praise and thanks are due the Washington Radio Club for the good work that made possible the success of these tests. We understand the fellows there, particularly the ones officiating in the relay, are forming a Sun Dodgers chapter of the Boiled Owl fraternity, and none will dispute their eligibility!

Thanks and congratulations are extended all the participating stations, and Headquarters also wish particularly to thank the large number of operators sending in logs for the nights in question, whose kindness in this respect has made available the data for this article.

## Police Chiefs Relay

*By F. H. Schnell, Traffic Manager*

**D**URING the month of March we enjoyed the success of the Governors-President Relay, which was the gathering of a number of messages and delivering them to one central point. The Police Chiefs Relay will be just the reverse of that. We are going to have one message which is to be distributed all over the United States and Canada by the A.R.R.L. and DELIVERED to your police chief.

The International Association of Chiefs of Police will meet in San Francisco during the week of June 19th. Chief August Vollmer, who is head of the organization, is going to invite every police chief to the convention and he is going to invite him by amateur radio. He will send a message which can be given to your police chief by

you and he is counting on the A.R.R.L. to DELIVER this message to every police chief in every village, hamlet, burg, city or town in the United States and Canada. WE CAN AND WILL DO IT. We must DELIVER it or the police chief will be without an invitation. We could set down definite schedules for the handling of this message but in order to derive some fun and a great deal of competitive sport from it we want every A.R.R.L. member to do his bit towards the success of the relay. Therefore there will be no schedules, no definite stations to handle it. We shall be "minute men of radio". We are going to have some real fun and plenty of excitement. Don't miss it! It makes no difference if you operate just a receiving station—you can supply messages and DELIVER them

and that is all that is necessary. There will be plenty of transmitters.

Here is the scheme:

Dates—June 3rd, 4th, and 5th.

Time—Sometime between 10:00 P.M. and midnight your local standard time some station will break loose with the message. The call letters of this station and the time of starting will not be made known. The message will come as a surprise right out of a clear sky. It will be broadcasted once at ten words a minute, each word being sent twice. Once a station broadcasts the message, that station will cease firing. That will be the start of the message.

The next thing to do is to copy it exactly as it is sent. Make at least two copies of the message. Then DELIVER one copy immediately to your police chief and have him sign the other copy with the date and time of receipt. (Have a heart and don't get him out of bed at two or three in the morning; get one of his representatives to sign for the message if the chief cannot be reached at that ungodly hour.) The copy of the message bearing the signature of the recipient must be sent to the Traffic Manager, 1045 Main St., Hartford, Conn., in

order that we may determine how many messages were delivered. This is very important. After you have DELIVERED your message and gotten your receipt, it is your turn to broadcast the message sending at the rate of ten words a minute and repeating each word twice. After you have broadcasted it once, cease firing.

The things to remember are these—make two copies of the message; DELIVER one to the chief and get his signature on the other; return the one bearing the chief's signature to A.R.R.L. headquarters (THIS IS MOST IMPORTANT BECAUSE IT IS THE ONLY WAY WE CAN DETERMINE THE EXACT NUMBER OF MESSAGES DELIVERED—DON'T NEGLECT THIS—WE WANT TO DELIVER ONE IN EVERY PLACE THAT BOASTS A POLICE CHIEF OR SHERIFF); broadcast the message only once sending each word twice at ten words per minute—give the little fellows a chance to copy it. Be sure and include your call letters when you send the copy of the message to the A.R.R.L. that we may give credit to every station DELIVERING a message. You yourself must report this.

## An Electromagnetic Changeover Switch

By Harold L. Olesen, Ex-2BQT

IN laying out a station the owner generally finds that he has the choice of a long roundabout antenna lead and the changeover switch within easy reach of the receiver or a short direct antenna lead and the changeover switch out of reach. Obviously each layout has its advantage and likewise its faults. For the owner who is going to do a lot of work the out of reach changeover switch is a bother—it delays coming back and generally means jumping up to reach the switch. On the other hand the indirect antenna lead often causes trouble and is to be avoided whenever possible.

The photograph shows a very simple device that puts an end to the antenna changeover switch location problem. It consists of a double pole double throw switch operated remote control by the aid of solenoid magnets. The construction is so simple that no detailed drawing need be given. The following notes will be of general interest.

Size of switch base 1x8x11"

Size of blades  $\frac{1}{2}$ x $\frac{3}{4}$ x7 $\frac{1}{2}$ "

Distance between blade pivot centers 3 $\frac{3}{8}$ "

Size of solenoid tube 1x9"  $\frac{1}{8}$ " thick

Size of each coil 2x3x $\frac{1}{4}$ "—wire only

Size of plunger  $\frac{3}{4}$ x3 $\frac{1}{2}$ "

Wire—about one pound of #26 DCC on each coil when used on 110V. A.C.

Trumbull switch lugs used by remounting them on fibre blocks.

The coils must be spaced apart slightly so as to make the centers of the coils far enough apart that the plunger will be out from under one center when under the other. The length of travel of the plunger is determined by the distance between coil centers.

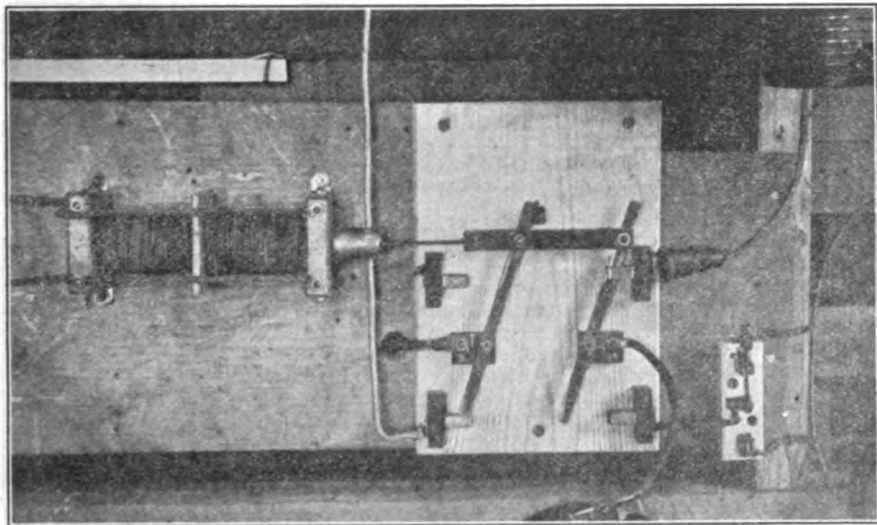
The easiest way to adjust the finished switch is to change the length of the arm that connects the plunger to the cross arm on the switch blades. Shorten it if the blades do not travel far enough to the right and lengthen it if they do not travel far enough to the left.

It is important that the tube be slotted lengthwise if a metal tube is used and the solenoid is to be operated on AC, in order to minimize any eddy current losses.

This switch can be located at any convenient place that will make the antenna lead as short and direct as possible. The control buttons are placed near the transmitter key at 2BQT. The transmitting key is located directly in front of the sounder and the control buttons to the right of the key. The rheostat and switch on the front edge of the table are in the 110V. AC leads

to the transmitter. By this arrangement the station can be operated from a seated position in front of the receiver or from a

For those who desire that the changeover switch turn on the power to the transmitter a third blade can be added between



position in an adjacent building where a second receiver and a second set of key, sounder, buttons, rheostat, and switch is located.

the present two. For those who are not using the tuned counterpoise-ground system the second blade can be used for power or may be omitted.

## ***Report on Receptions by British Amateurs in the Transatlantic Tests, December, 1921***

*By Philip R. Coursey, B.Sc., A.M.I.E.E.*

Mr. Coursey is assistant editor of the "Wireless World" and the "Radio Review", England's leading radio periodicals, and, as our readers recall, was in charge of the arrangements on the other side in our A.R.R.L. Transatlantic Tests. In this interesting article he tells us the story of the tests from the viewpoint of the British amateur.—Editor.

**F**ROM the British point of view the most striking feature of the recent Transatlantic Tests is the establishment of the fact that low power 200 meter signals have been heard over long ranges even with the limited aerial facilities allowed in Great Britain. For the first regular Transatlantic Test that was organized, i.e., in February, 1921, a remarkable amount of enthusiasm was shown, even by users of the simplest types of receiving apparatus, and the failure of those tests definitely to establish communication seriously damped the ardour of many for the second series of tests.

The failure of the first tests (February, 1921) I do not in any way attribute either to our listeners on this side, or to the apparatus they were using, but simply to the fact that the tests lasted only three nights. In the tests just completed, I think we have

conclusively shown that the transmission of the signals across the Atlantic cannot be relied upon to take place *every* night, as the atmospheric phenomena in the intervening space are too variable. Hence in the February tests lasting only three nights, the chances that anything would be heard were, as we see now, quite small—we should indeed have been very lucky if anything at all had been picked up on that occasion.

That being so, it may well be asked why signals from American amateurs have not been intercepted in this country before now. The reason, I think, is to be found in the five hours difference between our Greenwich Mean Time and your Eastern Standard Time (or the still greater difference between G.M.T. and the more western states), coupled with the fact that as a general rule, very very few of our men sit

up till the "wee sma' hours" of the morning unless there is something special to listen-in for. Since no relay work or the transmission of ordinary form of messages between amateur stations is allowed in the British Isles, there is no inducement to listen-in over long periods, unless the incentive is provided by some special signals or tests, such as the recent ones.

If one may draw conclusions from the articles and comments published in QST

and other American radio magazines, the opinion has been held apparently, by many in the United States, that the main reason why American amateurs signals have not been previously heard in England is not that stated above, but rather due to the "inferiority" of British receiving apparatus, and statements have more than once been made to the effect that if we used "regenerative" receivers with variometer tuning all would be well. In this connection, one or two points may well be borne in mind; viz:—

1—Although given the same general principles, radio workers in different countries may develop apparatus along different lines, it by no means follows that the resultant products differing both in appearance and in mode of use, are necessarily in any way very different in effectiveness and efficiency.

2—The fundamental principle of "regeneration" is primarily that of *feeding back* amplified energy from the plate circuit of the tube to the grid circuit. This being so, the exact mode in which the feed-back is effected is not of first importance provided that it is capable of fine adjustment and its use does not interfere with the proper functioning of the receiver. Variometer tuning of the plate circuit provides a fine adjustment for getting the valve into the sub-oscillatory position which is so desirable for the reception of spark signals, the feed-back being mainly through the inter-electrode capacity of the tube plus any other stray coupling that may be present. "Reaction coupling" (as we generally call it) of the plate circuit back to the grid is a more positive way of accomplishing the same result especially when the reaction

(or "tickler") coil is tuned, in which condition we frequently use it.

3—Since all the pre-war British amateurs' radio apparatus was confiscated by the British Post Office during the war and removed into Government stores, the resumption of wireless activities after the war in nearly every case necessitated the building of new apparatus—the earlier apparatus when returned often not being in a fit state for use again. Naturally

then under these conditions C.W. apparatus is used almost exclusively, with the result that our present receiving apparatus is in most cases designed primarily for C.W. work—in which case the sub-oscillatory state of the tube is not required—since it must either be oscillating, for "audodyne" reception, or a separate heterodyne oscillator tube must be used. The former is naturally the method most favored by the average radio amateur. For this arrangement the tuning of the anode circuit is effected quite as easily with a fixed coil and a variable condenser as with a variometer, and in fact in some cases the former method has advantages.

4—The value of the tuned plate circuit is quite well recognized by most British amateurs and was employed by

### 1ARY Spark Heard in France

QST is in receipt of a letter from Dr. Pierre Corret, editor of the French amateur radio magazine "La T.S.F. Moderne", advising that one of their readers, Mr. G. Perroux, of Paris, on February 5th copied the signals of 1ARY, University of Vermont, Burlington, Vt., on their spark set.

Mr. Perroux used a single-wire antenna about 35 ft. long with a slanting lead-in about 55 ft. long. The tube equipment consisted of one valve as a regenerative detector and three valves as audio-frequency amplifiers.

It is most remarkable to contemplate the reception of spark signals in France on this simple equipment! Mr. Perroux agrees with us that it is an unquestioned freak. He came in on the end of a transmission just to hear ".....ar 1ARY" and no further signals were received, but this much was copied without the slightest doubt as to the identity of the station.

Congratulations all around on another peach of a record—and *spark* this time!

the most successful receiving stations during the Tests, for the stages of radio frequency amplification used in front of the detector tube. Of course Mr. Godley as a visitor was granted more privileges than are normally allowed to the British amateur, who except in special cases is restricted to an aerial with a *total* amount of wire including down leads of not more than 140 feet, or 100 feet if only a single wire is used. Hence a companion of the ten or eleven stations heard by our amateurs on aerials of this size, with the twenty-three heard by Mr. Godley on his aerial of 850 feet is not so unfavorable, especially as only one Britisher used more than six valves all the time. It may here be of interest to note that 1BCG was read on a set consisting of two valves and a crystal detector by J. R. Forshaw of Omskirk near Liverpool.

To turn now to greater detail of the results—these are summarised in the cable-

Cape Girardeau. The same old routes are in operation besides this new route. 9AJN at Jefferson City clears thru 9MC in Roodhouse, Ill., very easily in daylight.

### PACIFIC DIVISION J. V. Wise, Mgr.

| C.W. |           | SPARK |           |
|------|-----------|-------|-----------|
| Sta. | No. Msgs. | Sta.  | No. Msgs. |
| 6ZB  | 37        | 6ZZ   | 194       |
| 6AK  | 4         | 6GT   | 176       |
| 6ZX  | 2         | 6ZX   | 155       |
|      | 43        | 6HP   | 107       |
|      |           | 6OL   | 32        |
|      |           | 6FH   | 30        |
|      |           | 6ZB   | 1         |
|      |           |       | 695       |

Southern Section—Lack of promptness in submitting reports is mainly responsible for the apparent poor showing of the Southern Section. A fairly large volume of traffic is really handled, but due credit cannot be given in QST unless we know of it by some other means than hearsay. Contrary to expectations, no regular traffic routes have been laid out, owing to the extreme difficulty of finding a sufficient number of stations willing to stand regular watches; however, there are enough stations operating at will to ensure messages going through in reasonable time.

C.W. is making a better and better showing, aided by the fact that so many of the reliable sparks are changing to the new order; long distance jumps east will soon be almost exclusively handled by this means. The fact that C.W. still has some drawbacks is apparent in that it cannot be copied satisfactorily in San Diego through NPL arc mush on 375 meters, although a powerful spark carries through.

The new Pacific Plan of traffic regulation, with its machinery for enforcement, is solving the QRM problem for all time. This plan having been endorsed by all Pacific Coast Radio Clubs, it is not surprising that amateurs are making the traffic officers' job an easy one by a universal willingness to co-operate for the common good.

The only known exception to this rule is in San Diego, where a small group of operators have combined in an effort to evade the new rules and use the air according to their own sweet will, without regard to anyone else's convenience. The most industrious members of this group have been barred from all further participation in A.R.R.L. work, and all stations are requested to note their calls, so that no traffic may be handled with them. The list follows: 6HH, 6ADA, 6AEH, 6BKH. The license of 6HH having been revoked by the Department of Commerce, the boycott will not apply against the per-

sons to whom it is reissued. 6BKH, under his old call, 6XZ, has already been under A.R.R.L. boycott for about a year.

District "A" (Arizona)—Our worst QRMers, the 6's, have been QRZ all season. Traffic from the west comes through very well from nearly all the C.W.'s, even the 5 watt stations; about forty messages were received from 6XAQ, who is doing exceptionally good work. Going east, about 100 messages each way were handled with 5IF (C.W.); other eastern stations regularly worked are 9DSD, 5ZAK, 5XU, 5IR, 5ZAC, 9AEG, etc. The majority of the work in Arizona is handled by 6ZZ; others doing good work are: 6AAH, 6ASV, 6GS, 6AFP, 6ZC. 6TV cleared traffic west very well for a time on spark, but is no longer heard and is supposed to have closed up.

District "B" (Arizona)—Riverside County reports only one station handling traffic, 6GT. As heard on the air, there have been many stations in this district showing increased activity. Among these are the following, which are doing good DX work: 6GT, 6FK, 6OE, 6EV, 6BAZ, 6TW, 6ACJ, 6AHE, 6AGK, 6AKC, 6AQY, 6AUC, 6BJV and 6AJH. Inactive hams please note that 6AJH, still on his back in bed following his fall with his mast, has his headset on the major part of the day and is doing all in his power to help put District "B" on the map. 6ZB's 20 watt C.W. has been copied in New Jersey, according to a card recently received. 6BAZ, our sole 7L (OW) has reached out as far as Sacramento on her ½ K.W. spark. 6FK and 6AGK will soon be added to the C.W. ranks. Now you fellows in District "B," let's get together and get all of our reports in when they are due, so as to have a real showing in the future.

District "C"—The natural trend is toward C.W.; nearly all the good old sparks are gone. C.W. stations now handling regular traffic are: 6JD, 6ZG, 6EN, 6KA, 6CU, 6KY, 6RR, 6EA, 6EB, 6ZN, 6ALU, 6XAQ, 6JD and 6EN are both using two 50 watt tubes, 6KA and 6RR are using one 50 watt and the rest are using one or more 5 watts. On February 22nd, 6KA exchanged greetings with 8JL, Cleveland, Ohio, and 6EN handled traffic with him without QTA on either end. 8JL reported that both could be read with the phones on the table.

6EN has also handled traffic with 8XV, and is going to establish a definite transcon schedule with him. Nearly all the sparks that are handling traffic are in or around Pasadena; among them are: 6MH, 6OL, 6OM, 6ADL, 6ACY, 6AMN, 6ALD, 6ALU, 6LC, 6GP. (6LC is so loud in San Diego that he often cannot be distinguished from a local spark.) An Assistant District Superintendent will be appointed for Pasa-

dena. Los Angeles is the star region for traffic.

District "D"—The only two stations heard in this district are 6ZU and 6AIF C.W. and spark.

District "E" & "F"—We find the old reliable on the job as usual. 6TU and 6OX in particular are doing excellent work followed closely by the Santa Cruz fellows. 6AS reports the gang doing fine work, but to get any material out of them to be used in a report, so far, has been impossible.

A number of stations in the vicinity of the Bay have been copied by 6ZAC in T.H. so this proves the stations are O.K. and all we need is a word from their operators. Adjoining District "F" is District "G." This District will also have a District Superintendent next month. 6EX and 6AH are kings of sparks in Oakland yet; and have been on the job very regularly. 6HP in Richmond is doing fine work and on little power too.

District "H," 6GF, Superintendent—This district has suffered the loss of most of its A1 stations this last month. The rebuilding bug hit them all at once, altho we have no word of an increase in wages. 6FH, and 6ZX, were left to handle most of the work and had little trouble in doing it. Both these stations are now equipped with C.W. and spark, 6ZX using C.W. on 375 and 200; spark on 200 only.

District "I"—The only station heard in this entire district last month was 6AIX, who goes north fine, but not south, and for this reason he can only get a limited amount of traffic.

District "J"—6BIP has made his appearance on the air with a good spark set. 6ZO is back in Reno and is installing a C.W. and fone set. 6MO has been reported as QRK in Washington, D. C. However, he is not handling traffic regularly. A spark in use at 6UO. 6AJR of Reno has been an old reliable all this last month. His spark is making good now.

#### ROANOKE DIVISION

W. T. Gravely, Mgr.

Heavy sleets and storms have played wild with a good many stations in the division this month but still the old faithfuls have been on the job and traffic has moved through with fair rapidity. The number of C.W. stations is on the increase.

8SP has joined the ranks of the illustrious for his sigs have been heard by 6AME and 7ZS. He has now been heard in every district. Fine work, OM, hope you will be able to make an every-day thing out of it soon. West Virginia leads in the number of msgs. handled and in general efficiency for the month. There are now several stations that form almost constant watch, probably the star station being

8AXY who is using spark to fine advantage. 8AFD, 8WD and 8AEU all spark doing fine work. 8AXY is reported to stay up all the time. Wonder how he ever finds time to sleep. 6's and 7's are copied by him 'most any time.

Virginia seems to be quiet for the time being, due to several good stations being out on account of sleet and sickness of operators. Several daylight stations have been opened up, among them being 3BLF and 3BII. There is need of a good station in Petersburg—who wants the job? General activities for the month have been a little under par.

North Carolina is gradually getting in better shape. There have been added several new C.W. stations during the month, one at Asheville and another at Shelby. Stations in general have been doing very good work but bad weather conditions have somewhat hampered activities. Asheville is within daylight range of Winston-Salem who has a daily schedule with Danville 3BZ. Charlotte, Shelby, Greensboro and Salisbury are all on within daylight range of the Manager's station, making it easy for the Division Manager to communicate with the whole Carolina end of his route by short jump routes.

Traffic in general for the month has not been up to the previous months' record. Several stations that had previously handled considerable traffic have been out with aerial trouble, on a number of occasions. Co-operation is the thing that will get results for the division and if everyone is on the job and puts some life into things then the old division will go to the top and hold the place that the Manager hopes for it to assume.

#### DELTA DIVISION

H. E. deBen, Acting Mgr.

| C.W. |           | SPARK |           |
|------|-----------|-------|-----------|
| Stn. | No. Msgs. | Stn.  | No. Msgs. |
| 5LA  | 42        | 5DA   | 75        |
| 5JB  | 21        | 5AA   | 69        |
| 5WF  | 7         | 5JD   | 69        |
|      |           | 5KC   | 36        |
|      | 70        | 5YE   | 15        |

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Relaying in the Division slackened up to some extent during the past month due mainly to the steadily increasing QRN. However, we are determined not to give Old Man QRN another summer victory and accordingly are working out short jump relay routes throughout the Division. All stations desiring appointments on these routes are invited to communicate with their District Superintendent. It is hoped that by organizing short jump relay routes, with stations located from 50 to 100 miles apart, and with the aid of



C.W. that we will be able to pierce the worst QRN. In this day of radio frequency amplification, loop aeralis, and highly efficient transmitters, the feat should not be a difficult one to accomplish.

Arkansas—5JB, Roy Disheroon, has been appointed City Manager of Hot Springs and is doing fine work with his C.W. set. 5UE has been appointed official relay station for Conway. 5JD continues to do good work. 5ZL has just returned from St. Louis chuck full of pep and a head full of knowledge—we know things are going to wake up now. Bro Jawn learned a lot about controlling QRM out St. Louis way and will no doubt show us how it's done.

Louisiana—5KC has been handling a goodly bit of traffic of late and his sigs continue to increase in strength. Two newly licensed stations now on the air: 5ABA 10 watt C.W., and 5AAT  $\frac{1}{2}$  K.W. spark at Baton Rouge, also plenty of squeak boxes. 5ZAB out of operation due to remodeling and installation of C.W. transmitter. Manard, City Mgr. of Nola, reports that the only stations working DX are: 5HO on 50 watts C.W., 5LA on 15 watts C.W., and 5AA on  $\frac{1}{2}$  K.W. spark. 5HO, a newcomer in the League, has a 50 watt bottle pouring 3 amps in the antenna and has been reaching out to real respectable distances. 5LA is still using 15 watts but gets out even better than formerly.

Mississippi—5YE is still the only DX station in the state of Mississippi and is indeed well capable of taking care of all Mississippi traffic. 5YE has handled much traffic during the past month.

Tennessee—All DX stations continue to do good work in spite of bad weather conditions. 5FV is heard nightly and is handling his portion of the traffic. 5KU has been appointed City Manager of Memphis. Mr. King has a 20 watt C.W. set which is putting the traffic over in fine style. 5DA continues to defy the elements out his way and we take the liberty to predict that this will be one station that will cause OM QRN to utter a groan.

#### ONTARIO DIVISION

A. H. K. Russell, Mgr.

| C.W. |     |      | SPARK |     |      |
|------|-----|------|-------|-----|------|
| Stn. | No. | Mgs. | Stn.  | No. | Mgs. |
| 9AL  | 30  |      | 3EI   | 32  |      |
| 3EI  | 5   |      | 3JL   | 18  |      |
|      | —   |      | 3GN   | 17  |      |
|      | 35  |      | 3BA   | 14  |      |
|      |     |      | 3QJ   | 4   |      |
|      |     |      |       | —   |      |
|      |     |      |       | 85  |      |

March has been excellent for relay work, but as usual the D.M. has the greatest difficulty in coaxing the different districts to make reports, and he hereby appeals to the various members of the A.R.R.L.

throughout Ontario to unite in an effort to make the monthly report a really representative report of relay work throughout the division. We have this month only reports from the Districts Nos. 2 and 3.

Gowan reports aeralis springing up like mushrooms all over his district. 3TP has opened up a phone transmitter and if he can be induced to use CW he will give 3BA a run for his money. 3QJ is being changed to 3TY. 3SB is still putting in that CW set. 3GN states that sigs from Toronto are rarely heard there, and then QSS very badly, tho strong and steady in Windsor. He reports 3MN clears London traffic regularly, and 3DL helps out lots. Tillsonburg 3RV and 3TA are both good.

Toronto district No. 8 has done well. 3EI reports working as far as Miami, Florida, with his  $\frac{1}{2}$  K.W. while 3JI, a new 5 watt tube set, in nine days from opening up handled 5 messages and worked to Iowa.

No reports have been received from other districts but Rogers 3BP was heard working 6BO one night this month on his C.W. set.

The new laws are not yet in force in Canada, but an inkling that they are easing is that Ottawa has issued an order that on opening of navigation all C.W. stations are empowered to carry on to the winter wave, i.e., 200 meters. Spark stations on the contrary return to the summer footing, i.e., 50 and 100 metres. That sounds like ding dong bell for the poor old pebble squashers.

#### NORTHWESTERN DIVISION

H. F. Mason, Mgr.

What's the matter, fellows? Don't let the first splash of summer static, or the radio telephones get your goat. Stay on the air, and be one of our RELIABLE stations. With the coming of summer it's going to be harder to clear traffic, and we need your help. We are calling on EVERY station to send in a report of activities to his nearest division officer on the 15th of the month. Don't let yours be missing.

Eastern Section—Traffic has been moving in good shape, although many of the operators were off on account of the flu a good part of the time. 7ZU and 7XB report few messages handled. 7LY also indulged in the flu, but was on strong during the Pres.-Gov. relay. The C.W. fever has at last taken the state of Montana and there will be a couple of good CW sets in Helena soon, and a 20 watt set at 7XB which will be followed by a 100 watt. They plan to work both Seattle and Chicago direct. F.B., 7MP of Bozeman takes the honors for most messages handled this month, and has worked 54 stations, even in spite of a crippled condenser.

Central Section—Activities in this section have taken a dip since 7NL, 7FI, and 7ZS are off the job. This leaves 7ZM

and 7YA on 375 the only stations handling any amount of traffic, and even 7YA reports hard times. As this section is depended upon for handling practically all of the eastern traffic from the western part of Washington and Oregon, it is essential that at least one good 200 meter station be on the job.

**Washington Section**—Puget Sound stations continue to work consistently, especially to the south. Stations handling the bulk of the traffic are 7BC, 7BK, 7QB and 7HI. 7GE at Pasco, Wash., is also doing good DX, but no reports. 7QB has a schedule with 4CB (Canadian) to handle eastbound traffic on C.W. Down at Grays Harbor, 7SC is installing C.W., I.C.W., spark and fone, and reports activities on the increase since he arrived. 7KJ and 7NN are the principal stations there at present.

**Oregon Section**—7KE, newly appointed D.S. at Myrtle Point, Oregon, reports that he is working easily into the 6th District, covering 600 miles on a quarter kilowatt. 7OX is putting up a half K.W. set for DX work.

In Portland: 7DP has been clearing traffic on C.W. Sparks who have been doing DX are 7JW, 7ZT, 7GJ, 7ED and 7ZJ. The number of messages handled, tho, is extremely low, and is a very poor showing against what these stations have done in the past. 7ZK of Vancouver, Wash., is back on the job, surprising the fellows with a 500 cycle spark. No reports from Eugene or Salem although 7MU at Salem is reaching out on spark since 7TJ has gone to sea. 7HD, D.S. at Seaside, has his transmitter going again and is QSA through the division.

#### EAST GULF DIVISION B. W. Benning, Mgr.

| C.W. |           | SPARK |           |
|------|-----------|-------|-----------|
| Stn. | No. Msgs. | Stn.  | No. Msgs. |
| 4GL  | 475       | 5XA   | 192       |
| 4BY  | 329       | 4EZ   | 56        |
| 4FT  | 200       | 4AU   | 55        |
| 4II  | 142       | 4GN   | 46        |
| 4BF  | 121       | 4BI   | 45        |
| 4BQ  | 65        | 4HS   | 35        |
| 4YA  | 48        | 4GM   | 25        |
| 4CO  | 40        | 4FD   | 24        |
| 5XA  | 36        | 4DZ   | 12        |
| 4AZ  | 30        | 5GI   | 13        |
| 4ZE  | 30        | 4DH   | 9         |
| 4EL  | 25        | 4GU   | 5         |
| 4IW  | 25        | 5ON   | 1         |
| 4GE  | 18        |       |           |
| 4AS  | 15        |       | 518       |
| 4ZF  | 10        |       |           |
| 4BK  | 9         |       |           |
| 5ZI  | 1         |       |           |

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Florida—4ZE is trying some of the

new tuners for the coming season. He has a regular route now with 4DZ, which opens South Florida. 4FS has completed his C.W. set and is in line for traffic. 4BC continues to do DX and is improving his set for summer work. 4DZ is doing regular work with 1BQE, 3EZ and 4GN. This opens South Fla. in good shape. 4AW, our last winter's standby, has started a C.W. set. W. E. Wood, 4BS, has gallantly offered a report for Miami and we thank him. Miami has 10 licensed amateurs, with sets ranging from spark coils to 1 K.W. sets; 4ES has a good station and is going to install C.W. At St. Petersburg the local club is building a set to specifications and are having nightly code practice. 4IW, C.W., is on the air and does regular DX. 4BF broke loose about three weeks ago. This fine station has already been reported QSA on the Pacific Coast several times.

4II has been reported QSA in Burlington, Ia., and Newmarket, Ontario. Supt. Harrod is pleased to say that every city manager has been striving this month to show that the land of Palms and Placid Lakes contain real radio men. 4ZC is doing fine work, having worked into 34 states and Canada.

**Alabama**—City Mgr. Ansley of Birmingham reports that their one and only spark DX station, 5GI, was closed down for the most of the month, following a complaint made to the R. I. that he, 5GI, was interfering with radio-phone reception—the receiving station making the complaint was located about two blocks away and using two steps of R. F. amplification!!! Hi. 5GI has been given permission to open up again. This trouble of interfering with radio-phone reception will probably cease if the plans of the B'ham Wireless Assn. are adhered to. 5ZI, C.W., has broken through to 5XA and 8ARS and has handled one message. He reports that there are six licensed amateurs in Anniston. Mr. J. K. Moore has been appointed City Mgr. of Gadsden.

In Montgomery, City Mgr. Brooks reports that all DX work has been given up due to the fact that all the possibilities are spending their time listening to the phone concerts. (We wonder if they listen all night. DX work doesn't start before 11:00 P.M.) 5NI has given up blowing condensers on his rock crusher and is building a low powered phone set. 5XR has installed C.W. City Mgr. Barnett of Mobile advises that the Radio Inspector recently visited Mobile and assisted by the chief operator of NGT tuned all the amateur stations there. 5KB is on 200 and 5JZ on 195 meters. Two new 5 watt C.W. stations are 5ACO and 5ACB.

5XA in Auburn has been the old standby and is still trying to do the work that 20

or 30 stations ought to be doing in this state. The 10 watt C.W. set is putting out .8 of an amp. and 750 miles is easy work for it.

South Carolina—4LA at Spartanburg has been absent from that city for some time and communication between 4LA and 4EG has been suspended. 4EG has established communication with 4AS at Macon, Ga. 4LA, 4IB, 4HR, 4HG and 4FI are in operation. Supt. Etheredge thinks that much progress will be made by his state during the next month and that we will have some reliable relay routes through the state by May.

North Georgia—Supt. Hight reports ports his district quite active during the past month. Extreme interest in radio has been exhibited by citizens in general. 4BQ made a talk before the Kiwanis Club of Rome, his subject being "Amateur Wireless and The American Radio Relay League." By request he repeated this talk before the Rotary Club and the Berry's Industrial School. 4BQ's CW signals are being heard all over the United States and Canada; he had 42 reports from the Pacific Coast in 20 days of operation, such reports including Vancouver, B. C., Seattle, San Francisco, Los Angeles, and Sacramento.

Middle Georgia—Midville 4GN has no trouble in working Fla. stations, having handled traffic with 4EZ. 4FD junked his CW for spark again. 4DH is putting in a 50 watt CW set. 4AS in Macon has been reaching all over the country with his new 10-watt CW set and is handling a good bit of traffic. 4GU, also on 10 watts of CW, has been stepping about over DX. 4BW reports that he has at last found a condenser that will hold his gravel grinder and is getting over the back fence. 4JH has installed a 50 watt CW set in place of his 10 watt and is in line for relay work at the present writing. 4BK swore off radio again. (HI—This is the fifth time Rankin has quit in the past 6 months. He will come back in a few days—he always does.)

South Georgia—That famous combination of 4GL, 4BY, 4EL, and 4GE smashed all our traffic records again this month and seem to be real angry that Atlanta had the nerve to nose them out of first place last month. Supt. Hodge reports that steady communication is held with Florida stations 4ZC, 4BF, 4IF, and 4II. Reliable communication is had with 5XA of Auburn, Ala., and 4FT of Atlanta. Won't some of you new radio men of Talbetten, St. Marys, Waycross, Boston, Valosta, Beuna-Vista and other places get in touch with Supt. Hodge? In Atlanta, 4FT was decreased somewhat this month due to the fact that the "Atlanta Constitution" is using the station temporarily for a broadcasting station.

## DAKOTA DIVISION Boyd Phelps, Mgr.

All district superintendents are busy lining up stations in the smaller towns for summer relay routes over which messages must be handled to insure delivery. The Southern Minnesota District is particularly lively in this respect and it had occasion to show its worth during the isolation of the Twin Cities when storms cut off all communications.

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.**  
Of QST, published monthly at Hartford, Conn. for April 1, 1922.

County of Hartford }  
State of Connecticut } ss.

Before me a Notary Public in and for the State and county aforesaid personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of QST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.

2. That the owners are: (Give names and addresses of the individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock). The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If they are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company but also, in cases where the stockholder or security holder appeared upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only).

K. B. Warner  
Sworn to and subscribed before me this 24th day of March, 1922.  
Wm. Lacey Wells, Notary Public  
(My commission expires February 1, 1925.)

# Who's Who in AMATEUR WIRELESS



**B. W. Benning**

"Our Genial Division Manager"—as all the fellows in the East Gulf call him—was born in Atlanta, Ga., March 9, 1897. Having been interested in electricity since 1909 he was the easy victim of the bite of the wireless bug in 1913. The first symptom of this awful disease was inflicting a coherer and other miscellaneous junk upon the household. In 1915 he graduated (with all due honors) from the spark coil class and for two hideous months radiated so much QRM on the DX men of the city that they threatened several different kinds of murder. He was finally taken into the Atlanta Radio Club and educated by pre-war 4CL, 4BY, 4AT, and 4DG. Installing a 2 K.W. open core transformer with electrolytic interrupter in 1916, he blossomed out with the call 4DX. "DX" was a good call but didn't mean anything.

During the war he served in the Navy

(Concluded on page 54)



**Albert J. Lorimer**

Born Nov. 7, 1897, at Farnham, Quebec, Canada, our Quebec Division Manager launched his radio career soon after. Troubles with land-line telegraphy in 1912 turned his interests to radio. Passing from the coherer to the potato detector stage, and from the spark coil to the quarter kilowatt, this rival of Marconi stepped forward in the world.

In 1915 he moved to New York City and entered the service of the Western Electric Co. When the lid was lifted he was located in Montreal and operated Canadian 2BF with a  $\frac{1}{2}$  K.W. quenched outfit and worked 2TF at Schenectady with fair regularity. Later when the resulting QRM hindered VCA the spark set was gotten rid of and a 250 watt I.C.W. installed, resulting in a great increase in range. 2BF is now being relocated at Farnham and will soon be heard from.



**C**LUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

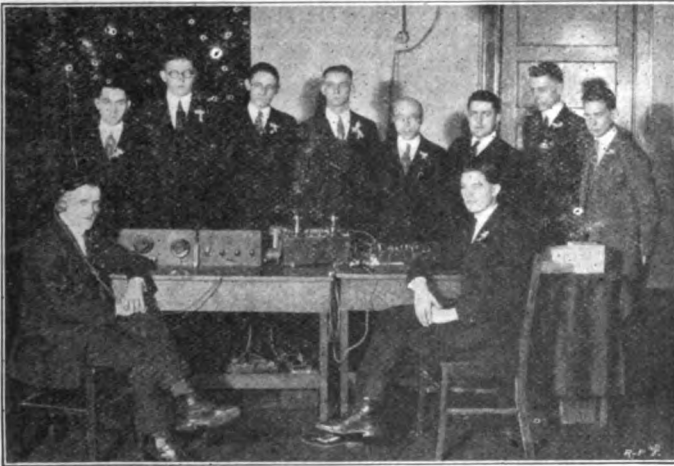
The Detroit radio clubs have adopted a novel scheme for enforcing their regulations. They have several blanks of different colors which are used to report viola-

Andrew White and W. A. Easton. The dance was held February 24th.

Interesting lectures are given every week and one of the most important of all will be a lecture by Paul F. Godley, our hero of the Transatlantic Tests. His subject will be the "regenerative receiver". The club extends an invitation to surrounding organizations of the second district to send their delegates to this meeting which will be held on Tuesday evening May 9th at 8 P.M. sharp.

The officers are R. H. Horning, pres.; G. Bosler, vice pres.; C. A. Reberger, secy.; H. Ryder, treas.; H. Luttgens, traffic manager; P. J. Larsen, technical advisor.

The following papers were received sur-



Officers and members of the High Power Committee of Roselle Park Radio Club, and set used at radio dance. Left to right, Wm. Pinter (sitting); M. C. Lane, P. J. Larsen; C. A. Reberger, sec.; R. H. Horning, president; G. Bosler, vice-pres.; H. T. Ryder, treas.; F. Schiffler, J. Smith, and H. Luttgens (sitting).

tions. When a station is violating the regulations several amateurs sign a blank and send it to the station and another copy to the radio inspector. For the first offense a blue blank is sent for warning. No mention is made of other colors except red—and a red blank means action by the radio inspector. The scheme works splendidly and as yet no one has received the "red ticket".

#### Roselle Park (N. J.) Radio Club

The first affair attempted by the club was a dance with the music furnished by WJZ through the courtesies of Major J.

ing the month and we advise all of you to read your local paper as some very vital points can be cleared up in your locality through the medium of such means for distributing information.

Totem Radio News—official organ of Totem Radio Club.

Delta Division News—by Delta Division A.R.R.L.

The Radio Log—by Radio Club of Brooklyn.

The Michigan Radioist—by Central Michigan Wireless Association.

The Oscillators—by Radio Engineering Society of Pittsburgh.

**The Modulator**—by Radio Association of Greater New York.

**The Oscillator**—by Y.M.C.A. Radio Club of Sioux Falls, S.D.

**Kickbacks**—by Twin City Radio Club.

#### **Scenic Highway Radio Club (Clinton Ia.)**

The club held its annual election February 13th and is pleased to announce the following names to serve for 1922: G. A. Gummerson, pres.; W. Pringle, vice pres.; G. Stukas, sec'y-treas.; J. Baker, corres. secy.

Four operators will handle traffic on the new 1 K.W. spark set which is in operation. Single circuit tuners are used extensively by members of the club. (Come on—give us some dope on them.—T.M.)

#### **Ypsilanti (Mich.) Radio Association**

The meeting of the past year consisted of code practice and lectures. The membership has nearly doubled in that time though there are but three licensed amateurs. F. N. Furlong has been elected president vice F. F. Sims who left for the Naval Academy.

#### **Southern Ontario Radio Association**

New officers for the coming year were elected at the last regular meeting: R. E. Moore, pres.; K. S. Atkinson, vice pres.; R. C. Hunt, treas.; C. R. Waage, secy. The advisory committee consists of D. Aitchison, W. Baker, and R. Bridwell. The welcoming committee—C. Lane, G. Brett, and J. Green. The traffic committee—R. Moore, R. Bertrand, and H. Wilson.

#### **Haddonfield (N. J.) Radio League**

New officers for the coming year are: E. Farrington, pres.; J. L. Barnes, vice pres.; E. Braddock, secy.; G. Barnes, treas.; J. G. Haydock, chairman of technical committee.

Regular meetings are held every other Saturday evening at the home of Thomas Sherrod.

#### **Fort Worth (Tex.) Radio Club**

The semi-annual election of officers was held March 2nd. The following officers were elected: Prof. O. R. Garrett, pres.; R. L. Harris, vice pres.; M. Smith, secy and treas.; O. Yeary, sgt.-at-arms. Prof. Garrett will start a series of lectures that will cover the field from beginner up.

#### **Mystic Valley (Mass.) Radio Club**

At the last meeting new officers were elected for the year of 1922: E. Baker, pres.; L. Gordon, vice pres.; E. D. Austin,

secy.; L. Hitichens, treas. The club will be glad to exchange correspondence with all radio clubs. Address all mail to the secretary at 1 Kern St., Malden, Mass.

#### **Philadelphia Amateur Radio Association**

At a meeting on March 6th, a paper on



Photo of Roselle Park Radio Club members and their apparatus, on the night of the affair

"British Aircraft Tube Transmission" was read by W. B. Martin.

Some very amusing questions on radio which were taken from a New York newspaper were read by the president. A discussion on "radio frequency amplification" was led by H. Van Sciver. The discussion was fully covered. (We would like to know the result of the discussion.—T.M.)

#### **Hudson Amateur Radio Club (N. Y. C.)**

The Hudson Amateur Radio Club meets Saturday evenings at the Columbia Preparatory School, 301 West 8th Street, New York City.

Mr. Stern of the Western Electric Company spoke on various types of antenna in common use; Mr. Gawler of the Radio Corporation of America spoke on the history of the Amateur Radio in the New England States, and Mr. D. S. Brown of the Radio Club of America gave an interesting talk on the theory of vacuum tubes with their application to modern receiving circuits. Mr. C. G. Kilbourne, our Vice President, also spoke on getting the most out of our C.W. sets. We have also been favored with short talks by different members of the club.

Over sixty percent of the members are licensed amateurs holding either first or second grade licenses.

The club is a member of the Second District Executive Council.

#### **8AGZ Heard in Hawaii!**

The latest station to be reported by Mr. Dow, 6ZAC in Hawaii, is 8YT, formerly 8AGZ, the station of Mr. C. J. Carter at East Cleveland, Ohio. 4500 miles on 100 watts, 375 meters. Fine business!

# Strays

Regarding the article on loop reception by 3ZY in last QST, the experiments have been continued and it was found that the large two-turn tickler was not as good for regeneration as tuning the plate circuit with a variometer, and the latter plan has been adopted. All of the secondary was then placed on the loop itself. The result now is that with two stages of audio amplification a lot of DX C.W. is being heard readably all over the room.

To check the possible effect of the antenna, the set was taken to a vacant lot—and better results got than ever.

Irving Vermilya, "VN", 1ZE-ex-1HAA, "Amateur Number One", old-time brass pounder, manager of Marconi's old WCC, and more lately Senior Shift Engineer at WSOJ, Marion, Mass., left the employ of the Radio Corporation on April 10th to become the manager of the new radio department of a New Bedford firm, Slocum & Kilburn. Going to carry everything from crystals to 99-stage amplifiers, VN says, and even going to run a 250-watt broadcaster. Regular pirate!

We know that all of Familiar's friends join us in wishing him best of luck in his new job.

"To hell with C.W."—1ZE, August 15, 1921.

"I am now in favor of passing a law against all sparks—no excuse for them."—1ZE, March 31, 1922.

Who put the 'broad in Broadcast?

The Weston Elec. Inst. Co. of Newark, N.J. announce the appointment of the following Sales Representatives:

Shiefer Electric Co., Inc., with offices at Rochester, Buffalo and Syracuse, for upper New York State and Erie, Pa.

L. D. Joralemon, Otis Bldg., Philadelphia, for Pennsylvania, Delaware, Maryland and District of Columbia.

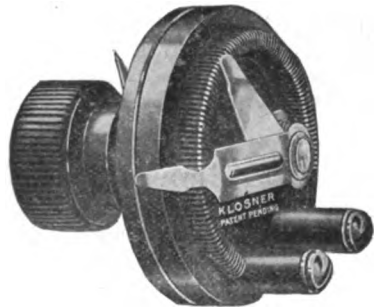
Warren C. Graham Co., Carondelet Bldg., New Orleans, for Louisiana, Mississippi and Lower Alabama.

The Anthracite Radio Shop, P. O. Box 3, Scranton, Pa., of which Roy C. Ehrhardt is treasurer, has succeeded the Shotton

Radio Mfg. Co. in that city, the latter company now being located in Albany.

S. M. Kintner, who is well known for his research and engineering work in the development of radio apparatus, has been appointed manager of the research department of the Westinghouse Electric & Manufacturing Company, succeeding C. E. Skinner, who has been made assistant director of engineering in the Westinghouse company. He will be located in the research laboratory building near East Pittsburgh, Pa.

Here is an illustration of a new vernier rheostat, the Klosner, which is especially designed for gaseous detector tubes requiring critical adjustment. In addition to the regular rheostat winding it has a



second resistance consisting of a single turn of the same wire running around the base of the device and provided with another contact arm. A single knob actuates either slider, the shaft to which the vernier is attached pulling out to engage a clutch on which the main contact arm is mounted.

The young lady across the way says she heard that nice Mr. Hanson of 9XM say he had gotten rid of his corona. She supposes the poor man will have to keep up his correspondence in long-hand hereafter.

The young lady says Mr. Hanson said the stations along the Mexican border just eat up all the C.W. he can feed them. She says she just can't keep up with all those new breakfast-foods anyhow!

9YAE of Le Mars, Ia., informs us that at present they use spark instead of C.W. as reported in the March issue.

Allow us to extend our condolences to A. Ham Wright. He asked a friend what he could do with his pet Tron tube having a broken-off grid lead and was advised that it would make a fine bobber for a fish line. He is now being held by the County Game Commissioner on a charge of fishing with lights!

A new way to test amplifier tubes: tap with a hammer to determine the degree of hardness.

We understand WLB-9XI is broadcasting potatoes on 485 meters. Moral: Run your lead-in to the dining room.

**DID IT EVER OCCUR TO YOU THAT:** An old 4D coil has a good filter condenser in the base?

It is NOT more blessed to give than to receive in radio?

When giving long calls you might fade out before you get to your call?

200 meters was meant to use?

At the rate VT's are being manufactured the world's supply of vacuum may soon be exhausted?

The study of radio will drive you nuts sooner or later?

G. R. Hammond, of Olwein, Iowa, sold out 9ZQ and turned in his Special a year ago with the foolish idea he would quit radio. Now he is back again as 9HE. Radio can't be quit!

1BN is now W. A. Jecusio, 47 Day St., Ansonia, Conn.

8SE has moved to Box 1044, Uniontown, Pa.

Ad in "Denver Post": "Wireless receiving set with andiron doctor, cheap". Why use vacuum tubes?

Breathes there a Ham with soul so dead,  
Who after reading QST for Feb.  
Did not exclaim aloud with joy,  
This is my Native Land, "Oh Boy!"

### Read 'Em and Weep

8BO of Detroit has been using a single five-watt tube for nine months and on it has handled traffic with 4BF of St. Petersburg, Fla., 9WU of Ellendale, N.D., and is consistently heard by 6XAD.

8HJ of Elmira, N.Y., has been heard very QRK on 10 watts by 6XAD.

4GL (described in February QST) using three five watt tubes has been reported 1700 miles west of Vancouver.

2AYV has been reported on 10 watts over a foot from the phones by 7JS at Anacortes, Wash., using one tube.

5ZA uses two fifty watt tubes, one as

oscillator and one as modulator, and has been reported on phone very loud in Canada, New Jersey, Virginia, Minnesota, New York, and many other places 1,000 to 1,800 miles distant.

6ZE has again been copied in Hawaii, this time with eight-tenths of an ampere from two five-watt tubes.

6ZZ has been heard on one tube, one wire aerial, and one-circuit tuner at Watertown, Mass., also at 1BWD at Calais, Me.

6PT on five watts and 6KA on C.W. and spark have been heard QSA on one tube by 8FT.

8SP of Fairmont, W. Va., using 10<sup>00</sup> watts C.W. has been copied by 6AMF, Riverbank, Calif., and 7ZS, Pullman, Wash.

4CO has been reported by Canadians 5CN and 9BD, both of Vancouver, B. C., and has heard 6XAD, 6ZZ, and 6ATG.

8AGZ sends us a list of 34 Pacific Coast stations who have heard him.

8AGO of Pittsburgh reports working 6BO for a half hour on fifteen watts, very QRK and slight QSS.

The statement made in the January QST concerning the first time a First District station had heard a Sixth District station has caused considerable comment and incidentally has brought in a lot of good records. Arthur E. Ericson at Beverly, Mass., reports that he has heard 6KA and 6ALE at least twice a month, confirming all reception, previous to that mentioned in QST.

In this day and age of everyone getting interested in radio we find the best "experts" behind the counter selling tuners in department and hardware stores. The following is quoted from a circular letter of a large concern: "—capacity up to 400 meter wave length on one battery and higher with two batteries." Also in "The Wireless Man" by F. A. Collins, "The sending key is similar to that of the telegraph except that it is unusually large and made entirely of wood... At a signal the powerful dynamos are released and the whirr and rush of the machinery suddenly fills the air. As the wooden key is pressed the thundering report of the spark stuns one's ears..."

### Wot tha Dosh Dat!

*Two hams were testing out a VT.*

First Ham: "The first test we are going to run will tell whether it is a stable tube or not."

Second Ham: "How does a stable tube act? Hey?"

First Ham: "It makes a hoarse noise in the phones."

Word has reached us that our fellow amateur William R. Klorig of 4404 W. 16th St., Chicago, passed away on Dec. 29th. He had many friends among radio men in Chicago and those outside may remember him.  
(Concluded on page 54)



## With Our Radiophone Listeners

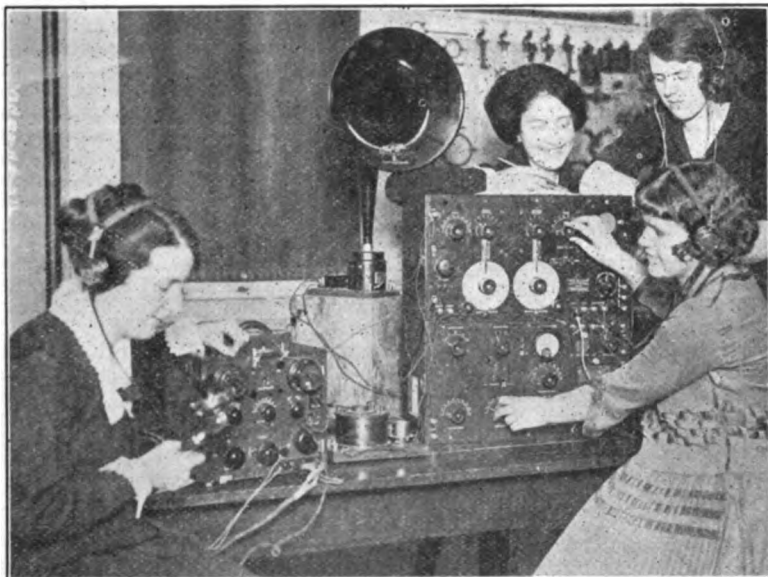
The following is the revised schedule of the Amrad station WGI (formerly 1XE) at Medford Hillside, Mass., wave length 350 meters: Police reports nightly at 7:55 p.m. followed by sermons and music on Sunday, business reports on Monday, bedtime stories for children on Tuesday and Thursday, special music on Wednesday, code practice on Friday, and news on Saturday.

The University of Wisconsin, call WHA, has been a prominent pioneer in the middle-west broadcasting, doing it solely from the amateur standpoint. Daily, except Sunday, from 12 noon to 12:25 the market report and weather forecast is sent by 4 K.W. spark on a wave of 485 meters. This is

stores entering the broadcasting field. In Philadelphia we have WFI—Strawbridge & Clothier, WIP—Gimbel's, WOO—Wanamaker's, as well as WGL—T. F. J. Howlett, ex-3AWI.

The Doubleday-Hill Electric Co., of Washington, D. C., wish to announce that their new station WMU will put on a program every afternoon from 4:30 to 5:30 and also Thursday and Friday from 7:30 to 8:30.

The Atlantic (Ga.) Journal's station WSB broadcasts concerts on 360 meters and news bulletins, market reports, and weather reports on 485 meters.



—Photo by Underwood & Underwood

**RADCLIFFE COLLEGE GIRLS OPERATE NEW RADIO STATION**—These students are sending messages to their parents in various parts of the country by radiophone from Radcliffe College, Cambridge, Mass. Miss Eleanor Brennan is shown seated at the right, "tuning in." At the left, speaking into the transmitter, is Miss Katherine Miller of Salem, Ohio. Standing in the rear is Miss Margaret Cunningham taking down messages and Miss Susanne Dunn, of Erie, Penn., is listening in.

immediately repeated on the same wave by phone, together with special notices and announcements. On Saturdays the complete program for the coming week is given. Time signals are sent at 12:55 p.m. The regular concert is sent on 360 meters Friday evenings from 8 to 8:45, and in addition a lecture on radio subjects is given on the same wave Saturday afternoons at 1 p.m.

We note with interest the department

### Broadcast Stations

The Department of Commerce announces the following list of licensed broadcast stations as complete up to March 10th.

All of these stations employ the 360-meter wave for the broadcasting of music, concerts, lectures, etc., and those marked with the asterisk (\*) in addition broadcast market or weather reports on 485 meters, the official wave for that class of work.

| Owner                                | Location                | Call |
|--------------------------------------|-------------------------|------|
| Allen, Preston D.                    | Oakland, Calif.         | KZM  |
| American Radio & Research Corp.      | Medford Hillside, Mass. | WGI  |
| Atlantic-Pacific Radio Supplies Co.  | Oakland, Calif.         | KZY  |
| Ramberger, L., & Co.                 | Newark, N. J.           | WCR  |
| Bible Institute of Los Angeles, Inc. | Los Angeles, Calif.     | KJS  |
| Church of the Covenant               | Washington, D. C.       | WDM  |
| City of Chicago                      | Chicago, Ill.           | WBU  |
| Cox, Warren R.                       | Cleveland, Ohio         | WHK  |
| Crosley Mfg. Co.                     | Cincinnati, Ohio        | WLW  |
| DeForest Radio Telep. & Teleg. Co.   | New York, N. Y.         | WJX  |
| Detroit News, The                    | Detroit, Mich.          | *WWJ |
| Doubleday-Hill Electric Co.          | Pittsburgh, Pa.         | KQV  |
| Doron Brothers Electric Co.          | Hamilton, Ohio          | WRK  |
| Duck Co., Wm. B.                     | Toledo, Ohio            | WHU  |
| Dunn & Co., J. J.                    | Pasadena, Calif.        | KLB  |
| Electric Lighting & Supply Co.       | Hollywood, Calif.       | KGC  |
| Examiner Printing Co., The           | San Francisco, Calif.   | KUO  |
| General Electric Co.                 | Schenectady, N. Y.      | WGY  |
| Gilbert Co., A. C.                   | New Haven, Conn.        | WCJ  |
| Gould, C. O.                         | Stockton, Calif.        | KJQ  |
| Hamilton, Mfg. Co.                   | Indianapolis, Ind.      | WLK  |
| Hatfield Electric Co.                | Indianapolis, Ind.      | WOH  |
| Herrold, Chas. D.                    | San Jose, Calif.        | KQW  |
| Hobrecht, J. C.                      | Sacramento, Calif.      | KVQ  |
| Howlett, Thos. F. J.                 | Philadelphia, Pa.       | WGL  |
| Karlowa Radio Co.                    | Rock Island, Ill.       | *WOC |
| Kennedy Co., Colin B.                | Los Altos, Calif.       | KLP  |
| Kluge, Arno A.                       | Los Angeles, Calif.     | KQL  |
| Kraft, Vincent I.                    | Seattle, Wash.          | KJR  |
| Lorden, Edwin L.                     | San Francisco, Calif.   | KGB  |
| Marshall-Gerken Co.                  | Toledo, Ohio            | *WSZ |
| Metropolitan Utilities District      | Omaha, Nebr.            | *WOU |
| Meyberg Co., Leo J.                  | San Francisco, Calif.   | KDN  |
| Meyberg Co., Leo J.                  | Los Angeles, Calif.     | KYJ  |
| Missouri State Marketing Bureau      | Jefferson City, Mo.     | *WOS |
| Montgomery Light & Water Power Co.   | Montgomery, Ala.        | *WGH |
| Newspaper Printing Co.               | Pittsburgh, Pa.         | WPB  |
| Northern Radio & Electric Co.        | Seattle, Wash.          | KFC  |
| Palladium Printing Co.               | Richmond, Ind.          | *WOZ |
| Pine Bluff Co., The                  | Pine Bluff, Ark.        | WOK  |
| Pomona Fixture & Wiring Co.          | Pomona, Calif.          | KGF  |
| Portable Wireless Telephone Co.      | Stockton, Calif.        | KWG  |
| Precision Equipment Co.              | Cincinnati, Ohio        | *WMH |
| Precision Shop, The                  | Gridley, Calif.         | KFU  |
| Radio Construction & Electric Co.    | Washington, D. C.       | WDW  |
| Radio Corporation of America         | Roselle Park, N. J.     | WDY  |
| Radio Shop, The                      | Sunnyvale, Calif.       | KJJ  |
| Radio Telephone Shop, The            | San Francisco, Calif.   | KYY  |
| Reynolds Radio Co.                   | Denver, Colo.           | *KIZ |
| Rike Kumler Co., The                 | Dayton, Ohio            | *WFO |
| Rochester Times Union                | Rochester, N. Y.        | *WHQ |
| Seeley, Stuart W.                    | East Lansing, Mich.     | *WHW |
| Service Radio Equipment Co.          | Toledo, Ohio            | WJK  |
| Ship Owners Radio Service            | New York, N. Y.         | WDT  |
| Union College                        | Schenectady, N. Y.      | WRL  |
| University of Minnesota              | Minneapolis, Minn.      | *WLB |
| University of Wisconsin              | Madison, Wis.           | *WHA |
| Warner Bros.                         | Oakland, Calif.         | KLS  |
| Wasner, Louis                        | Seattle, Wash.          | KHQ  |
| Westinghouse Electric & Mfg. Co.     | Springfield, Mass.      | WBZ  |
| Westinghouse Electric & Mfg. Co.     | Chicago, Ill.           | KYW  |
| Westinghouse Electric & Mfg. Co.     | Newark, N. J.           | WJZ  |
| Westinghouse Electric & Mfg. Co.     | East Pittsburgh, Pa.    | KDKA |
| Western Radio Electric Co.           | Los Angeles, Calif.     | KOG  |
| Western Radio Co.                    | Kansas City, Mo.        | *WOQ |
| White & Boyer                        | Washington, D. C.       | WJH  |
| Wireless Telep. Co. of Hudson County | Jersey City, N. J.      | WNO  |

Practically all of the above stations have concert hours various evenings in the week. We have received many of their schedules, so many in fact that it would completely fill an issue of QST if we tried to print them. Most of the above have printed sheets for distribution, giving the evenings per week of concerts, lectures, news, etc. We therefore suggest that our readers interested write to the prominent stations in their vicinity and ask to be put on the mailing list for the weekly announcements of the coming week's program.

The photo on this page shows the station operated by the Signal Corps at Fort Wood, Bedloes Island, New York Harbor. The broadcast service is sent on 1400 meters with a 3K.W. set every evening from 9 to 9:55 p.m., call letters WYCB. The development of interest among amateurs and the establishment of contact with them by this and other means, will, it is hoped, result among other things in making practicable the building up of a complete radio net of qualified amateur stations who can and will be willing to assist the regular Army radio net in the transmission of official business during emergency or otherwise.

### An Appeal!

Have you ever listened in to a concert and heard a lot of funny (?) noises, squeals, howls, etc.? With a good three-

step amplifier and loud-speaker the family may be enjoying a concert when suddenly there will be a roar like a fire siren tearing thru the room that will make you jump. Or it may moan and groan, sending the children scampering to their mother; or render a hair-raising shriek not unlike that of a woman being murdered,—all in the midst of an otherwise beautiful concert or Unkle Wiggily story. Such occurrences happen nightly in most cities.

The trouble is not with your outfit, neither is it due to amateurs sending, in



Fort Wood - W. Y. C. B.  
"Broadcasting"  
22nd C. A. No. 299

the strict sense of the word. The trouble is caused by the listeners themselves!

Briefly the action is this: under certain conditions a receiving set may act as a miniature transmitter. Signals from such a set often carry several miles so it is not unnatural that with several such sets in the same block the noise may be terrific. This transmission only happens when the set is oscillating. Single circuit tuners, such as are common on the market for broadcast receiving because of their simplicity of operation, are especially violent in sending out waves.

After adjusting the tuning element of the set it will be noticed that when advancing the "tickler" or "regeneration" control the signals will increase in loudness up to a certain point. At this point there is a click or thud, beyond which the set oscillates and produces waves of its own. This condition is to be guarded against for the reasons stated above—it makes a transmitter out of your receiver.



—Photo by Underwood & Underwood

W. D. Terrell, Uncle Sam's Chief Radio Inspector at the Department of Commerce, who has been simply deluged with work since radio reception became a popular pastime. Mr. Terrell, boss of the amateurs, is known, respected and admired by the entire A.R.R.L.

Broadcasting stations have a "carrier wave" on which the voice and music travel but which is inaudible unless the receiving set is adjusted to the oscillating condition. In tuning slowly with the set oscillating these waves first become audible at a very high pitch and as the tuning knob is slowly



—Pitcher by Underwood & Underwood  
Every other magazine has published this picture so we suppose we might as well too. Originally entitled "Send Me a Kiss by Wireless," members of our staff respectfully suggest that the title might be improved—for example, "Radio teLEgraphy versus telephony," or why not "See the Shaft—on the Variometer."

turned the note decreases in pitch until it is so low it is inaudible for a short space, then rises to the higher audibility limit as the rotation is further continued. In this short space where the "carrier wave" is inaudible, music and voice *may* be picked up, which may or may not be badly distorted. This is just the stunt many of our listeners proceed to do. During this time their receiving sets are sending out waves which almost surely interfere with other listeners.

We do not mean to bring wrath upon such people as we believe not one in a hundred realizes what he is doing. We want you to know for your own information what happens and incidentally to take considerable blame off the shoulders of amateurs who own transmitting stations.

In Canada, England, and several other countries receiving stations are required to be licensed because of the interference it is possible for them to produce. We hope this will not be necessary in this country.

It will not be if the listeners can co-operate as relay amateurs have learned to do in the past.

Do not adjust your receiving set as described above. Keep it in a non-oscillating condition. The "tickler" or "regeneration" (whichever it is called on your set) should be kept well below the oscillating point, for tho the signals increase enormously when on the edge of oscillation, they will be badly distorted and as a general rule not as understandable. Don't interpret us as meaning weaker signals are clearer. The tuning should be as near perfect as possible so as to be on the exact wave and the most energy utilized. What we mean is, for the clearest and most understandable reproduction, do not "crowd" the signal too much by excess regeneration, and above all, for the sake of your neighbor, do not allow your set to oscillate.

#### B. W. BENNING

(Concluded from page 46)

and Marine Corps. Graduating from the Naval Radio School at Paris Island, S.C., in June, 1918, he did his share of guard duty just missing going to France as the Armistice was signed. In March, 1919, he was shipped to Port-Au-Prince, Haiti, where he nursed the generators and punched brass at NSC until discharged in October. He returned to Atlanta and stood the commercial exam, erecting station 4BZ in February, 1920. His present ambition as D.M. is to put the East Gulf Division on the top of the traffic percentage column and keep it there.

#### "STRAYS"

(Concluded from page 50)

member him as in charge of subscriptions to QST at our booth at the National Convention. We deeply mourn his loss.

#### WOULDN'T IT BE WONDERFUL—

If Henry Ford would buy up all the spark transmitters in the second district and use them for ship moorings?

If First Grade Commercial Operator's tickets could be bought like a dog's license?

If static could be used to charge the storage batteries?



# Calls Heard



## HEARD DURING MARCH

### Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instruction.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the C.W. stations.

#### Heard By 6NW While Operating Str. "WTT"

565 miles south of Ketchikan, Alaska, Mar. 1: Can.: 5AZ, 5DA, 5FE, 5NA, 9BD. U.S.: 6AJR, 6BIU, 6EA, 6FH, 6HY, 6IB, 6IC, 6MZ, 6OG, 6OL, 6PO, 6WO, 6VK, 6VX, 6ZU, 7BH, 7GJ, 7KE, 7LO, 7NZ, 7WG, 7YA.

300 miles south Ketchikan, Mar. 2: 6AGF, 6AJR, 6EX, 6IC, 6TU, 6VX, 6ZX.

38 miles south Ketchikan, Mar. 3: 7YA, 7YL, 7ZM.

20 miles south Ketchikan, Mar. 4: 7HD, 7KS.

#### Heard by Opr. Mexican S.S. "Mexico"

At Guaymas, Sonora, Mexico: 5BI, 5BY, 5EH, 5EW, 5FA, 5HK, 5IF, 5IQ, 5IR, 5KP, 5LB, 5NH, 5NS, 5OF, 5QQ, 5QT, 5RA, 5TD, 5TG, 5VO, 5WC, 5XT, 5XU, 5YG, 5ZU, 5ZW, 5ZAD, 5ZAF, 5ZAG, 5DA, 5GR, 5GS, 5KC, 5LC, 5OL, 5QR, 5ZX, 5ZZ, 6AAH, 6AAK, 6AAW, 6ADA, 6AED, 6AEH, 6AMN, 6ASV, 6AUD, 6AVR, 6BGH, 6AEG, 6YAL, 6GT, 6OD, 6UK, 6AJH, 6APP, 6AOE.

At LaPas, Lower Calif.: 6AS, 6BG, 6EX, 6GR, 6HH, 6HB, 6LC, 6AFE, 6ALD, 6AWX, 6BGH, 6ZAL, 9BSD.

At Mazatlan, Sinaloa: 5AE, 5AL, 5BY, 5HK, 5IF, 5IQ, 5IS, 5JI, 5QQ, 5XB, 5XU, 5HY, 5KC, 5LC, 5OL, 5ZR, 6ZU, 6ZX, 6AEH, 6AFP, 6AMN, 9DZE.

At San Blas, Nayarit: 5IQ, 5JI, 5NK, 5QS, 5XB, 5XD, 5XI, 5XU, 5XG, 5EN, 6JI, 6LC, 6AHF, 6AJH, 6AVR.

At Manzanillo: 5JI, 5QA, 5TG, 5XB, 5XU, 5XG, 5ZE, 5ZAA, 9AEG.

#### Reported by D. L. Cawman, Operator, S.S. "J. R. Gordon. Detector One-Step"

Jan. 22—90 miles east Key West. Spk: 2FP, 3ACE, 3AJD, 4BQ, 4DZ, 4GN, 5ZAB, 5ZAG, 5XU, 5YM. C.W.: 1QN, 3BEC, 3BLF, 3ZB, 9ARK.

Jan. 28, 200 miles east Miami. Spk.: 2FP, 2JU, 4BC, 4GN, 9YC, 9APS, 4ZC, 5YL. C.W.: 1IV, 1QN, 2AVU, 4BY, 5EK, 8WA, 8AXK, 8BOX, 8BRL, 9ARK.

Jan. 24, 450 miles east Miami: Spk.: 2FP, 2DR, 2OO, 2OM, 2BJO, 3FB, 3AHK, 3AJD, 4BC, 4DH, 4DZ, 4BF, 5AA, 5NB, 5XU, 8UC, 8XE. C.W.: 1ARY, 2NZ, 3BA, 3DH, 3AJD, 3ZO, 8ADG, 9BLO.

Jan. 25, 680 miles east Miami: Spk.: 1RV, 2FP, 2OM, 3FB, 3HJ, 3ACE, 3AUW, 4EA, 4AU, 4DZ, 8AJW, 8BHD, 8AFD, 8XE. C.W.: 1BKQ, 2AAB, 2AWK, 3DH, 3FS, 3AQH, 4GL, 5FV, 8AQV, 9NX, 9AJA.

Jan. 26, 850 miles east Miami: Spk.: 1HO, 1APO, 1BOQ, 2BM, 2FP, 2OM, 3ARM, 4EA, 4DZ. C.W.: 2DK, 2AAB, 2AUW, 2BRB, 3AHK, 3BEC, 3BLF, 3AQR, 3NI, 8WY, 1BDI.

Jan. 27, 900 miles east Miami: Spk.: 2OM, 2ARY, 1XM, 3FB, 4EA. C.W.: 3AHK, 4BK, 5FV. Heavy QRN.

Jan. 28, 1150 miles southeast New York: 1UN on C.W. Very heavy QRN.

Jan. 31, 1687 miles southeast New York: Spark none. C.W.: 1XM, 2FP, 8BUM.

Feb. 2, 2100 miles southeast New York: No sparks. C.W.: DF1, 1XM.

March 5th on return trip, 2450 miles southeast N. Y. C.: Spark, 2EL, 2JZ, 1CZ, 1BDT (copied complete msg fm 1BDT). C.W.: 1XM, 2AWL, 2XQ, 4BY, 8XV, 9KP (3000 miles).

Mar. 6, 2280 mi. S.E. N. Y. C.: No sparks. C. W.: 2NZ, 2AWL.

Mar. 7, 2100 mi. S.E. No sparks. C.W.: 1XM, 3BA, 4BQ, 4BY.

Mar. 11, 1400 mi. S.E. N. Y. C., 1AKG on spark; 2NZ, NOF, C.W.

Mar. 12, 1250 mi. S.E. N. Y. C. Spk.: 2TS, 3FB, C.W.: 1XM, 1ZE, 2BML, 4BY, 4GL, 8ADG.

Mar. 13, 980 miles southeast New York: Spk.: 2EL, 1CJA, 1LF, 1COK, 2TS, 2OM, 2AGA, 3FB, 4DZ, 8XE. C.W.: 1BAS, 2BEH.

#### 1VT-1BWD, Calais, Maine

C.W.—1ADL, 1AFV, 1AIP, 1AJF, 1AJP, 1AKG, 1AKQ, 1AKR, 1ARY, (1ASF), 1AWP, (1AZW), 1AZX, 1BAS, 1BBW, 1BCF, 1BDC, 1BDE, (1BDI), 1BEA, (1BEP), 1BH, 1BKO, (1BKQ), 1BKR, 1BLE, 1BOC, (1BQE), 1BQI, 1BRQ, 1BSD, 1BTL, 1BUA, 1BUB, (1BWJ), 1BYX, 1CAK, 1CGE, 1CGS, 1CIE, 1CIT, 1CIV, (1CK), 1CLA, (1CMK), 1COD, 1CZ, 1EZ, 1FD, 1II, 1ON, 1PR, 1PT, 1QP, 1UN, 1XM, (1YK), 1ZE, 2AAB, 2AAG, 2ABZ, 2AJA, 2AJF, 2AWF, 2AWK, (2AYV), 2BA, 2BAK, 2BEA, 2BGM, 2BLP, 2BML, 2BNZ, 2BQD, 2BTJ, 2BTW, 2BUM, 2CBW, 2CBL, 2EH, 2FP, 2NZ, 2OF, 2SQ, 2UD, 2UF, 2VA, 2VH, 2XQ, 2ZK, (8ADX), 3AJD, 3AJU, 3AMW, 3ANJ, 3ANY, 3APA, 3APD, 3AQR, 3BAG, 3BEC, 3BFU, 3BG, 3BHL, 3BNU, 3BP, 3BQ, 3BTK, 3BUQ, 3BUV, 3CG, 3CZ, 3FS, 3HG, 3IZ, (3JJ), 3KM, 3LR, 3NH, 3QZ, 3RW, 3SY, (3TA), 3XL, 3ZO, 3ZY, 3ZZ, 4BHL, 4BY, 4GL, 4KM, 4ZC, 4ZE, 5ZA, 8ACF, 8ACZ, 8ADG, 8ADZ, 8ACK, 8AGV, 8AGZ, 8AIM, 8AIU, 8AM, 8AMK, 8AMN, 8AOC, 8ANR, 8APT, 8AQF, 8ARK, 8ASG, 8AVD, 8AUH, 8AWM, 8AWN, 8AWP, 8AWX, 8AXK, 8BDU, 8BEF, 8BFX, 8BK, 8BLJ, 8BO, 8BUQ, (8CBJ), 8CFS, 8CFP, 8CKM, 8CKO, 8DV, 8HM, 8IQ, 8JO, 8KA, 8KS, (8NB), (8OZ), 8PL, 8QR, 8QZ, 8RW, 8SE, 8SP, (8TB), 8UK, 8VJ, 8WE, 8XE, 8XV, 8ZAE, 9AAP, 9AAV, 9AAY, 9AJA, 9ARK, 9AXF, 9BSG, 9BWU, 9CEP, 9DP, 9IO, 9VY, 9WC, 9WE, 9XI.

Spark—1ARY, 1AW, 1BDT, (1BHO), (1BJC), 1BJZ, 1BQA, 1BRQ, 1CHJ, 1CNI, 1GN, 1LZ, 1SN, 1XM, 2BPF, 2JZ, 2OM, 2PV, 3GN, 8BSS, 8ADG, 8XE.

#### 1BOE, Southport, Conn.

Spark—1AA, 1ABZ, 1ADL, 1AKH, 1AJP, 1AKG, 1APO, 1AQO, 1ARY, (1AVW), 1AYQ, 1AZT, 1BCF, 1BDT, (1BGC), (1BGW), 1BJE, (1BKQ), (1BM), 1BMT, 1EOQ, (1BQC), 1BQL, 1BRQ, 1BSD, 1BSZ, 1BVV, 1BVH, 1BYT, 1CIL, 1CJA, 1CK, (1CM), 1CNM, 1COK, (1CSP), 1CUS, 1CZ, 1FW, 1GM, 1HO, 1JT, 1OZ, 1RX, 1SN, 1UJ, 1WQ, 1YB, 2ABM, 2ACU, 2ACY, 2AGA, 2AHU, 2AJE, 2AL, 2AWF, 2AXK, 2BFS, 2BFX, 2BJO, 2BK, 2BO, 2BRS, 2BY, (2BZV), 2CT, (2DI), 2DO, 2DX, (2EL), 2FP, 2GK, 2HJ, 2IG, 2JZ, 2NZ, 2OM, 2OX, 2PF, 2RG, (2RM), 2SH, (2TS), 2TU, (2WB), 2WV, 2XK, 3AJD, 3AN, 3ARM, 3ARN, (3FB), 3FP, 3GX, 3GZ, 3NB, 3OU, 3YV, 4AS, (4BC), 4DQ, 4DZ, (4EA), 4GN, 5XA, 5AFA, 5AFB, 5AFD, 5AFG, 5AHH, 5AOT, 5APB, 5ARD, 5AVT, 5AVY, 5XY, 5AYN, 5BAZ, 5BCO, 5BEP, 5BSY, 5CH, 5EO, 5FI, 5FT, 5HG, 5HY, 5KG, 5LB, 5LH, 5NZ, 5PL, 5PQ, (5RQ), 5SP, 5TY, 5UC, 5WC, 5XE, 5YV, 5ZN, 5ZP, 9AAP.

9AGR, 9AIR, 9AZE, 9DCX, 9RC, 9UH, 9UU, 9ZJ.  
Can. 3BP, 3FO, 3GE, 3GN, 3JL, 3KG.

C.W.—1ABB, 1ABY, 1ADL, 1AJP, 1AOL, 1AWB, 1AZW, 1BDI, 1BEA, 1BGF, 1BKP, 1BQE, 1BSD, 1BUA, 1BUJ, 1BWJ, 1BYX, (1CAC), 1CGS, 1CIK, (1CJZ), 1FF, 1II, (1IV), 1NE, 1ON, 1OZ, 1QP, 1RD, (1RZ), 1SQ, 1UJ, (1VQ), 1XM, 2AAB, 2ABZ, 2AEQ, 2AFP, 2AJA, 2AJF, 2AJR, 2AKO, 2ANZ, 2AQU, 2ARO, 2ASH, 2AVU, 2AWL, 2AWS, 2AYV, 2AZZ, 2BCF, 2BDM, 2BEA, 2BEB, 2BEH, 2BFF, 2BFX, 2BFZ, 2BGA, 2BGM, 2BLP, 2BML, 2BMR, 2BND, 2BNH, 2BNZ, 2BPD, 2BQA, (2BQU), 2BQW, 2BRB, 2BSC, 2BTJ, 2BUA, 2BUM, 2BYW, (2BZV), 2CAH, 2CBT, 2CBW, 2CCD, 2CEC, 2CFA, 2CFI, 2CFT, 2CFY, 2CHL, 2CIM, 2CIZ, (2CRO), 2DK, 2EH, 2FC, 2FD, 2FF, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2RY, 2SC, 2SQ, 2UJ, 2VA, 2VC, 2VH, 2WR, 2ZK, 2ZL, 3AAE, 3AAG, 3ALN, 3AQR, 3BA, 3BAG, 3BHL, 3BIJ, 3BIY, 3BLF, 3CA, 3CM, 3IL, 3LR, 3MO, 3NH, 3QZ, 3RF, 3SQ, 3ZO, 3ZY, 3ZZ, 4AS, 4BF, 4BY, 4DC, 4EH, 4GL, 4GU, 4ID, 4II, 4LP, 4YA, 4ZC, 4ZE, 5AAM, 5FV, 5IF, 5KU, 5ABV, 5ADG, 5AGO, 5AGZ, 5AHK, 5AJT, 5AJV, 5ALB, 5AMF, 5AMM, 5ANC, 5AQF, 5AQV, 5AQZ, 5ARK, 5ARW, 5ATR, 5AWM, 5AWP, 5AWR, 5AXC, 5BBD, 5BCL, 5BDO, 5BDU, 5BEX, 5BFX, 5BLT, 5BNY, 5BRL, 5BSS, 5BZH, 5CAZ, 5CBJ, (5CFS), 5CGY, 5CLD, 5CNA, 5CNS, 5COO, 5DV, 5GE, 5HM, 5IQ, 5LB, 5QZ, (5TB), 5UK, 5VY, 5WR, 5ZAE, 5ZM, 5ZX, 5ZZ, 9AAV, 9AKR, 9ARK, 9ATA, 9BRL, 9DAX, 9GC, 9KP, 9UH, 9XI.

#### 1BPR, Cambridge, Mass.—All C.W.

1FO, 1II, 1ON, 1QP, 1RZ, 1XZ, 1YK, 1ZE, 1ADL, 1ARL, 1AWB, 1AZW, 1AZX, 1BEA, 1BEP, 1BES, 1BGF, 1BKP, 1BRQ, 1BSD, 1BUA, 1CAK, 1CGS, 1CIK, 1CJH, 2FD, 2FZ, 2KP, 2KU, 2NZ, 2OF, 2PZ, 2SQ, 2TP, 2VA, 2VC, 2VH, 2WR, 2WT, 2XQ, 2ZK, 2ZS, 2AAB, 2ABZ, 2AFP, 2AJF, 2AJR, 2AQF, 2AQU, 2AWF, 2AWL, 2AWS, 2AYV, 2AZZ, 2BAK, 2BCF, 2BEA, 2BEB, 2BEH, 2BEM, 2BFQ, 2BFX, 2BGI, 2BGM, 2BML, 2BNC, 2BNZ, 2BRC, 2BTJ, 2BUM, 2BXD, 2BYW, 2CCD, 2CCU, 2CDA, 2CFA, 2CGQ, 3BA, 3BG, 3BZ, 3CC, 3CG, 3CM, 3FS, 3HG, 3HJ, 3IZ, 3JH, 3KM, 3LR, 3NO, 3PB, 3QV, 3QZ, 3RF, 3RW, 3VW, 3XL, 3ZO, 3ZY, 3ZZ, 3AAD, 3AAY, 3ADT, 3ADX, 3ALN, 3ANJ, 3APS, 3APQ, 3AQH, 3AQR, 3BAG, 3BFU, 3BHL, 3BIY, 3BKS, 3XAA, 4AS, 4BQ, 4BY, 4DC, 4FT, 4GL, 4ID, 4II, 4LP, 4YA, 4ZC, 4ZE, 5FV, 5IF, 5BK, 5BO, 5BU, 5DV, 5GE, 5HJ, 5HT, 5IQ, 5JL, 5JU, 5KH, 5KS, 5LX, 5MP, 5OS, 5QM, 5QZ, 5RQ, 5SE, 5SP, 5TB, 5UK, 5VY, 5WR, 5XE, 5XV, 5ZX, 5ACF, 5ADG (dalite), 5AGO, 5AGZ, 5AIM, 5AIO, 5AMK, 5AMM, 5AND, 5ANJ, 5AOA, 5AOG, 5AQF, 5AQV, 5ARK, 5ARW, 5AVD, 5AWM, 5AWP, 5AWY, 5AXC, 5AXK, 5BBD, 5BBK, 5BCL, 5BCL, 5BDO, 5BDU, 5BEF, 5BFX, 5BLT, 5BNJ, 5BRL, 5BSO, 5BSS, 5BTO, 5BUQ, 5BZH, 5BZY, 5CAZ, 5CBJ, 5CFF, 5CFS, 5CKM, 5CLD, 5CNS, 5COO, 5YAA, 5ZAE (dalite), 9EI, 9FZ, 9HH, 9HW, 9IO, 9IZ, 9KP, 9UC, 9UH, 9WA, 9ZL, 9AAP, 9AAS, 9AAV, 9AAJ, 9AKR, 9ARK, 9AYH, 9BRL, 9BSG, 9DAM, 9DAX, 9DYN, Canadian 2BG, 3BP, 3CZ, 9AL, 9AW.

#### F. G. Sands, Danbury, Conn.

C.W.—1ADL, 1AJP, 1ARY, 1AVR, 1AWB, 1AZW, 1AZX, 1BAS, 1BEA, 1BEP, 1BES, 1BDC, 1BGF, 1BGP, 1BKP, 1BKQ, 1BKR, 1BLE, 1BSD, 1BTL, 1BUA, 1BUJ, 1BYX, 1CAK, 1CGS, 1CIK, 1CIV, 1CJO, 1CJZ, 1CK, 1CLI, 1COD, 1CPZ, 1CRH, 1DAC, 1EZ, 1FF, 1II, 1IV, 1IJ, 1OW, 1ON, 1QN, 1QP, 1RD, 1RZ, 1TS, 1UJ, 1VJ, 1VG, 1VT, 1XM, 1ZE, 2AAB, 2AAZ, 2ADL, 2ACH, 2AFP, 2AJF, 2AJW, 2AQU, 2AVU, 2AWF, 2AWJ, 2AWL, 2AYV, 2BAK, 2BCA, 2BEA, 2BEH, 2BEM, 2BFG, 2BGI, 2BGM, 2BHL, 2BML, 2BNZ, 2BQU, 2BQC, 2BRW, 2BTJ, 2BUM, 2BYW, 2CBT, 2CC, 2CDA, 2CEC, 2CGQ, 2EH, 2FD, 2FP, 2FZ, 2JJ, 2KU, 2KV, 2NZ, 2OF, 2PZ, 2SM, 2SQ, 2SY, 2WJ, 2VA, 2XQ, 2AAD, 2AAG, 2ACQ, 3GT, 3AJD, 3AJN, 3ANQ, 3ANY, 3APA, 3APQ, 3AQR, 3AVY, 3BAG, 3BFQ, 3BG, 3BHL, 3BKS, 3BNU, Canadian 3BP, 3BPQ, 3BQ, 3BUV, 3BY, 3CA, 3CC, 3FF, 3FR, 3FS, 3GL, 3GT, 3HD, 3HJ, 3IJD, 3KM, 3LR, 3NH, 3VW, 3WF, 3XL, 3ZAB, 3ZO, 3ZY, 3ZZ, 4BY, 4BQ, 4DC, 4ID, 4II, 4ZC, 5UN, 5ACF, 5ADG, 5ADJ, 5AGO, 5AIG, 5AIN,

8AJT, 8AJV, 8AND, 8ANJ, 8ANR, 8AOO, 8ARK, 8AVD, 8AWM, 8AWP, 8AZZ, 8BDR, 8BDU, 8BEX, 8BIZ, 8BOX, 8BUG, 8BXA, 8CBJ, 8DV, 8EV, 8GE, 8HM, 8JS, 8NV, 8OS, 8OZ, 8QY, 8SE, 8SP, 8TB, 8UK, 8ZAE, 9AAV, 9AJA, 9ARK, 9BLO, 9BRL, 9IO, 9KP, 9PF.

Spark—1ADL, 1APO, 1ARM, 1ARY, 1AW, 1BEP, 1BOE, 1BOP, 1BOQ, 1BQA, 1BVH, 1CGS, 1CK, 1COK, 1HO, 2ABM, 2AHU, 2AJE, 2BJO, 2CKF, 2CT, 2EL, 2FP, 2GP, 2GX, 2JZ, 3AAB, 3ACM, 3AIC, 3AJD, 3AK, 3ALD, 3ALN, 3ARM, 3GN, 3GX, 3IJD, 3JW, 3NB, 3OU, 3RW, 3US, 3VW, 3YP, 3YV, 3AHH, 3AHS, 3BRL, 3CFS, 3XE, 3ZA, 3ZP.

#### 2BLL, Paterson, N. J.

C.W.—1ABB, 1AJP, 1ANY, 1ARY, 1ARV, 1AWF, 1BDC, 1BEP, 1BKQ, 1BKQ, 1BMO, 1BUA, 1CAK, 1COD, 1XM, 1XX, 3AAY, 3APB, 3AJD, 3ALN, 3AQH, 3AZR, 3BAG, 3BGL, 3BHL, 3BLF, 3BNU, 3BZ, 3CC, 3CM, 3GN, 3IL, 3LL, 3MN, 3QZ, 3RW, 3VA, 3VZ, 3ZO, 3ZY, 3ZZ, 4BQ, 4BY, 4DC, 4FT, 4GL, 4PT, 4ZC, 4ZY, 5AN, 5UU, 5AGK, 5AGN, 5AGO, 5AGZ, 5AIM, 5AJN, 5AJW, 5ANR, 5AOA, 5AOP, 5AQF, 5ARU, 5AWM, 5AWP, 5AXC, 5AXR, 5AZV, 5BAZ, 5BBD, 5BBK, 5BBO, 5BCL, 5BDO, 5BEF, 5BET, 5BFX, 5BK, 5BNV, 5BO, 5BOX, 5BR, 5RL, 5BUG, 5BY, 5BYE, 5BZC, 5CKO, 5GE, 5IB, 5IK, 5IP, 5JU, 5LW, 5MP, 5PT, 5PX, 5QZ, 5RY, 5SE, 5SM, 5SP, 5UK, 5WO, 5WR, 5WY, 5XK, 5XV, 5XY, 5ZAE, 5ZN, 5ZV, 9AAV, 9AAJ, 9ARK, 9AWA, 9BDU, 9BMM, 9BRL, 9EI, 9IO, 9KP, 9OU, 9ZAC, 9ZJ, 9ZL, Can. 3BP.

Spark—1ARY, 3AWD, 3ND, 3ARD, 3BSY, 3RQ, 3XE.

#### 2AWF, Albany N. Y.

Spark: 1AA, (1ADL), (1BHR), (1BJS), (1BOP), 1BOQ, 1BQA, (1BQL), (1BRQ), (1BYG), 1COK, (1GM), 1HO, 1QO, (1RV), (1SN), 1UB, 1UL, (1WQ), 2AAF, 2AIM, 2AJE, 2ARY, 2BJO, 2DA, 2DI, 2EL, 2JZ, 2OM, (2RM), 2TS, 2WB, 3ACM, 3AGT, 3AJD, 3AK, 3AN, 3ANJ, 3AQZ, 3ARM, 3BDU, 3BKQ, (3EH), 3FB, 3FP, 3HJ, 3OU, 3QW, 3TA, (3UD), 3YK, 4BC, 4CX, 4EA, 4FD, 4AAP, 4ACF, 4AFB, 4AFD, 4AFG, (4AHH), 4AJT, 4ANW, 4APB, 4AUY, 4AXO, 4BAH, 4BCO, 4BEP, 4BFH, 4BSS, 4BSY, 4BUN, 4DY, 4EO, 4EV, 4EW, 4FT, 4LB, 4LH, 4PL, 4OE, 4QC, 4RQ, 4WO, 4WZ, 4XE, 4YN, 9AAP, 9AAW, 9ACB, 9AGR, (9AIR), 9DCX, 9DFX, 9DIO, 9DWP, (9GX), 9KI, 9MC, 9UH, 9YB, 9YQ, 9ZJ, Can.: 3BP, (3FO), 3GE, 3JL.

C.W.—(1ADL), 1AJP, 1AMQ, 1AWB, 1AZW, (1BGF), 1BVS, 1BWJ, (1CAK), 1CGS, 1CJZ, 1CKP, 1CLN, 1CMK, 1RZ, 1UJ, 1ZE, 2AAB, 2AFP, 2AID, 2AJE, 2AKO, 2ALR, 2AMO, 2AZO, 2AZZ, (2BBB), 2BEM, (2BGI), 2BML, 2BND, 2BRC, 2BUM, 2CAT, 2CBG, 2CFI, 2EH, 2FP, 3FQ, 3KP, 2SQ, 2VH, 2WI, 2WT, 3AAD, 3AAE, 3ADT, 3ANJ, 3ANQ, 3APA, 3APQ, 3ASO, 3AWA, 3BFQ, 3BG, 3BHL, (3BIJ), 3BIY, (3CC), 3CG, 3CM, 3FS, 3HJ, 3IZ, (3KM), 3RI, 3US, 3VW, 3ZN, 3ZO, 4BQ, 4BY, 4CD, 4CO, 4DC, 4EH, 4FT, 4GL, 4II, (4LP), 4YA, 4ZC, 4ZE, 5AAM, 5DA, 5EK, 5FV, 5KU, 5ACF, (8AJT), (8ALB), 8ALV, 8AMD, 8AQF, 8AQV, 8ARW, 8AVH, 8AWY, 8AWZ, 8BDU, 8BEX, 8BK, 8BOX, 8BRL, 8BTO, 8BUN, 8BZG, 8BZH, 8CFS, (8CKO), (8COO), 8DV, 8HJ, (8IQ), 8OW, 8PN, (8QZ), 8RQ, 8VY, 8WR, 8XAE, 8XE, 8ZG, 8ZZ, 9AAP, 9AAS, 9AAV, 9AJA, 9AKD, 9ALH, 9ASL, 9BED, 9BRL, 9DAX, 9EI, (9KP), 9PF, 9ZL, Can. 2BG, 3BP.

#### 2AVE, Jamaica, L. I.

C.W.—1II, 1ON, 1PR, (1RZ), 1VQ, 1XM, 1YK, 1AIP, 1AJP, 1AJS, 1ANR, 1ARY, 1ASF, 1AVR, 1BQE, 1CAC, 1CAK, 1CJH, (2AB), (2FC), (2RY), (2AEH), (2AEQ), (2AJF), (2AMX), (2ATJ), (2AVU), (2BNC), (2BQW), (2BRM), (2BSC), (2BUQ), (2BWA), (2BWW), (2CDW), 3BA, 3BG, 3CA, 3FS, 3GH, 3HG, 3IL, 3LR, 3QZ, 3RP, 3ZY, 3AJD, 3ALE, 3ALN, 3ANJ, 3APQ, 3AQH, 3AQR, 3BAG, 3BEC, 3BFU, 3BHL, 3BOP, 3BQV, 3BUV, 4BF, 4BQ, 4BY, 4CO, 4DC, 4GL, 4JH, 4KK, 4XD, 4ZC, 5FV, 5BK, 5DV, 5HJ, 5HM, 5HT, 5LX, 5NB, 5OS, 5OW, 5QB, 5QM, 5QZ, 5SF, 5VY, 5XE, 5XV, 5ZE, 5ZY, 5ACF, 5ADG, 5AGO, 5AGZ, 5AIO, 5ALB, 5ANC, 5AOA, 5AQV, 5ARK, 5ARW, 5AWP, 5AXC, 5AXK, 5BBB, 5BBK, 5BCL, 5BDB.





**C. E. Watkins, Ft. Pierce, Fla.**

Spark—1AW, 2EL, 3AL, 4AS, 4BQ, 5ZA, 8ZY, 9AAW, 9ZN.

C.W.—1XJ, 2EH, 2XQ, 2AAX, 2AKO, 3MO, 3BEC, 4EN, 4II, 4CD, 4CY, 4DQ, 4ID, 4XC, 4JC, 4CO, 5KP, 5RO, 5XA, 5XU, 5ZAB, 5ZL, 5BEN, 5BEP, 9DHB fone.

**4HZ, Jacksonville, Fla.**

Spark—2EH, 3AO1, 3AOV, 3HJ, 3QV, 3ZW, 3ZX, 4AG, 4BC, 4BI, 4CX, 4FD, 4GN, 4GU, 4HS, 4IX, 4XJ, 5AAB, 5AZ, 5CX, 5GI, 5GU, 5KK, 5ON, 5XA, 5XC, 5AAC, 5AFD, 5AOT, 5BSY, 5CH, 5DFH, 5EO, 5IIZ, 5KG, 5NO, 5XE, 5ZO, 9AI, 9AJT, 9APB, 9ARD, 9BHR, 9DQ, 9GX, 9HR, 9IGE, 9LK, 9UH, 9UU.

C.W.—1AJP, 1ALW, 2BEA, 2DK, 2NZ, 2ZK, 3AKA, 3AM, 3APA, 3AQR, 3AZR, 3BG, 3BHL, 3BIJ, 3BLF, 3CA, 3CC, 3JH, 3LP, 3QZ, 3RV, 4AS, 4BB, 4BQ, 4BY, 4DS, 4EH (fone), 4EN, 4GL, 4GU, 4GX, 4ID, 4II, 4IW, 4JH, 4KM, 4LP, 4XD, 4ZC, 5AAC, 5DA, 5EK, 5FV, 5IF, 5LA, 5LI, 5WO, 5ZA, 5ABV, 5AIG, 5AIM, 5AIO, 5ALB, 5ALT, 5APF, 5BDU, 5BET, 5BFX, 5BK, 5BUN, 5BZU, 5BZY, 5CFS, 5CNA, 5DV, 5GE, 5KH, 5PT, 5XAE, 5XE, 5XZ (fone), 5ZX, 9AIM, 9AL, 9ALV, 9BRL, 9JD (fon), 9JT, 9KP, 9ZL.

**5CI, Frost, Texas**

All C.W.—4BF, 4BQ, 4BY, 4CO, 4EV, 4FT, 4ID, 4II, 4YA, 4ZC, 4ZE, 5AAM, 5EK, 5FK, 5FV, 5IC, (5IG), (5IR), (5JB), (5JG), 5KP, (5MX), (5MZ), (5NR), (5NS), 5NZ, 5OI, 5UU, 5WO, 5XA, 5XJ, 5XU, 5ZA, (5ZAF, 5ZU, 5ZV, 5ZX, 6KA, 6KP, 6FT, 6ZZ, 8AGZ, 8AIM, 8ARD, 8ARW, 8AKK, 8AYV, 8BFX, 8BOX, 8BRL, 8BZY, 8CAX, 8CLD, 8VV, 8VY, 8WI, 8XAE, 9AAP, 9AAS, 9AAV, 9AEQ, 9AJA, 9AJV, 9AKR, 9ANE, 9ARK, 9ATR, 9BAK, 9BAL, 9BAM, 9BF, 9BFG, 9BJB, 9BJI, 9BJV, 9BLO, 9BNO, 9BRL, 9BSG, 9BUN, 9DKW, 9DPF, 9DTA, 9DTM, 9DTS, 9DUC, 9DUB, (9DZJ), 9DYN, 9DZQ, 9EI, 9EX, 9FM, (9FZ), 9GM, 9JI, 9PI, 9PS, 9PW, 9QE, (9RV), 9SL, 9VE, 9XI, 9XM, 9ZAF, 9ZG.

Fones—5XU, 5ZA, 5ZR, 9BNO, 9XM, 9ZAF.

**5ABA, 257 Maximilian St., Baton Rouge, La.**

2FP, 4AS, (4BF), 4BY, 4BQ, 4EB, 4EH, 4GL, 4HB, 4II, 4KD, 4LP, 4ZC, 5CI, 5DA, (5EK), 5FV, 5HO, 5IF, 5JI, (5KP), 5LA, 5ND, 5NZ, 5OG, 5UU, 5ZA, 5ZK, 5ZX, 8AW, 8AJT, 8AMT, 8AQH, 8BDV, (8BEX), 8BGF, 8BOV, 8BOX, 8DV, 8IX, 8XB, 8XU, 8XV, 8ZC, 9AAD, 9AAS, 9AAV, 9ABS, 9AEQ, 9AIM, 9AJV, 9AKA, 9AKD, 9AKR, 9ARW, 9AYH, 9AYS, 9AZK, 9BBF, 9BDP, 9BJB, 9BMD, 9BNO, 9BOW, 9BOQ, 9BSG, 9DFS, 9DPF, 9DQ, 9DSM, 9DTA, 9DTS, 9DTT, 9DZG, 9DZQ, 9EGS, 9FM, 9IO, 9KP, 9LE, 9PL, 9QE, 9SJ, 9SL, 9WA, (9ZE), 9ZL.

**5TC-5SF, Ft. Worth, Tex.**

Spark—4AU, 4DH, (5AE), 5AI, (5AM), (5BO), (5BY), (5EH), (5EW), (5FI), 5FO, 5HK, 5IF, (5IR), 5JI, 5KC, (5KK), (5KP), 5LB, (5LO), 5MF, (5MK), (5MM), (5NC), (5NF), (5NS), (5NZ), (5OI), (5PE), (5QA), (5QU), 5RA, (5SO), (5SM), 5TG, (5UD), (5UR), (5VF), (5WA), 5XR, 5XD, 5XA, 5XU, (5YG), 5ZR, 6ZZ, 7VV, 8FT, 9AEG, 9AEY, 9AIG, 9ABV, (9ANO), 9ANQ, 9AQW, 9AVB, (9AVX), (9AVZ), 9AOU, 9ASK, 9AYE, (9AMA), (9AMS), (9DSD), 9DQ, 9DZE, 9DZI, 9FF, (9FU), 9HI, 9MC, 9OI, (9LW), 9WI, 9WT, 9YAK, 9XAQ, (9RY), 9ZAC.

C.W.—1BE, 2ZL, 4BK, 4BQ, 4EL, 4FT (voice and C.W.), 4GL, 4HW, 4II, 4KD, 4ZC, 5AA, 5AAM, 5AMB, (5CI), 5EK, 5FV, 5GA, 5IC, 5JO, (5JG), (5KP), (5KV), 5LA, 5MT, 5ND, (5NK), (5NS), (5OI), (5QS), (5RB), 5ZA (fone and C.W.), 6AL, 6JD, 6JL, 6ZZ, 6XAD, 7AO, 8AGZ, 8ALB, 8AR, 8AYS, 8BET, 8BFX, 8BOX, 8BOW, 8BOX, 8GV, 8II, 8IV, 8VY, 8XA, 8ZAC, 9AAU, 9AEY, 9AKR, 9AVA, 9AY, 9AXI, 9BAD, 9BBF, (9BFG), 9BOA, 9BOW, 9DHB, (9DTA), 9DTM, 9DTS, 9DZQ, 9DZY, 9EK, 9EW, 9IP, 9NX, 9PS, 9QE, 9WD, 9WT, 9ZB, 9ZQ.

**6AHS, E. San Diego, Cal.—Crystal**

5RY, 5HK, 5XJ, 5XU, 5ZX, 7MO, 7NP, 7ZM, 7ZT, 7XD, 7ZU, 9AEG, 9AYW, 9DZE.

Wanted—More lists of calls from the Sixth District.—Ed.

**600, San Francisco**

C.W.—5ZA, 5FV, 5GV, (6AK), (6EA), 6EB, 6EN, 6GA, (6GY), 6KA, 6KU, 6KY, 6NX, 6PK, 6RR, 6SQ, 6TI, 6VM, (6ZE), 6ZF, 6ZI, 6ZN, 6ZQ, 6ZS, (6ZX), 6ZZ, 6AAT, (6AGP), (6ALV), 6ALU, 6BAK, 6BAW, (6BCR), 6BIR, 6BLA, 7DP, 7GO, 7NX, (7QT), 7ZU, 8BK, 8VV, 8AGZ, 8BRL, 8CLD, 9BRO, 9BJB, 9BSG, 9DTM, 9XAQ, 9ZAF, 9PI, (9WD), 9AAU, 9KP, 9AYS, 9DTH, 9PS, 9AJA.

**7GE, Pasco, Washington**

Spark—6AH, 6AJ, 6AS, (6BM), 6EB, 6ES, 6EX, (6FF), 6FH, (6GR), 6GX, 6IC, 6IM, 6IS, 6JJ, 6KA, 6KC, 6KM, 6LC, 6NX, 6OH, 6OO, 6PO, 6QK, (6QR), 6ST, 6TC, (6TU), 6UO, 6VK, 6VX, 6XH, 6ZK, (6ZX), 6AAU, 6ABO, (6ABW), 6ABX, 6AEI, (6AFN), (6AGF), 6AHR, 6AIX, (6AJR), 6AJT, 6AMZ, 6ARC, (6ARK), 6ATO, (6AVB), 6BAK, 6ZAM, (7AT), (7BC), 7BF, (7BG), 7BH, (7BJ), (7BK), 7BR, (7BZ), 7CD, (7CN), 7CU, 7CW, 7DP, (7ED), (7FJ), 7GJ, 7GP, 7GQ, 7HF, (7HI), 7IH, 7IN, 7IW, (7IY), 7JV, (7JW), 7KB, (7KE), (7KG), (7KJ), 7KT, 7KV, (7LY), (7MF), (7MP), 7MR, (7MU), 7MY, (7NL), (7NW), 7NZ, 7OH, 7OX, 7TC, (7TJ), (7TO), 7TQ, 7TS, 7UX, 7VF, (7VO), 7VX, (7VZ), (7WG), 7WM, 7YA, 7YB, 7YJ, 7YL, 7YS, 7ZB, (7ZK), 7ZM, 7ZP, 7ZT, 7ZU, 7ZV, 5AK, 5ZA, 9ZX, 9WD, (9AX Can.), (9BD Can.).

C.W.—4CB (Can.), (6AK CW & voice), 6EN, (6GY), (6F), 6AAT, (6ALE), (6AWT), (6BCD), 6XAD, 7AW, 7NF, (7QE), (7RN, CW and voice), 7XF CW and voice, 7AAV.

**7KP, Seattle, Wash.**

C.W.—4BQ, 5ZA, 6AAT, 6AIF, 6ALU, 6AWT, 6BCR, 6BDZ, 6CU, 6EN, 6FH, 6GY, 6KA, 6KY, 6NX, 6OO, 6VM, 6XAD, 6ZA, 6ZAD, 6ZB, 6ZF, 6ZQ, 6ZZ, 8AGZ, 9KP, 9PS, 9WD, 9WQ, 9AMB, 9YAE, 9ZAC, Can.: 4BT, 4CB, 5BI, 5CT, 9BD.

Spark—5CN, 6AJH, 6AJR, 6ARK, 6AVR, 6EX, 6GR, 6IB, 6IM, 6QH, 6QR, 6TU, 6UO, 6OH, 6XH, 6ZAM, 6ZU, Can. 9BD.

**8ASL, Fredonia, N. Y.**

Spark—1ARY, 1BOQ, 1RSZ, 1CM, 1HO, 1IW, 2AAM, 2AHU, 2AJE, 2AR, 2ARB, 2ASV, (2AWZ), 2BK, 2CIC, 2DA, 2DN, 2EL, 2FP, 2OM, 2OO, 2QW, 2TJ, 3AGT, 3AJT, 3ARM, 3AWF, 3BY, 3GM, 3HJ, 3LY, 3QW, 4BG, 4BI, 4CG, 4CX, 4EA, 4GN, 4GU, 5AAB, 5HK, 5XA, 5AAV, 5ADQ, 5AFA, 5AFD, (5AHE), 5AHH, (5AHQ), (5AHS), 5AIM, (5AIT), 5AIZ, 5AJT, 5AJV, (5AKQ), 5AMD, 5AMZ, 5ANW, (5AOI), (5ARD), 5ATU, (5AUG), (5AUV), (5AUZ), 5AVT, 5AVW, 5AXC, (5AXQ), 5AXY, 5AYC, 5AYL, (5AYM), 5BAZ, 5BBU, (5BCO), 5BDV, 5BEP, 5BFY, 5BID, 5BQC, 5BRL, (5BXC), 5BXX, (5YP), (5CAS), 5CEB, (5CFE), 5CGZ, (5CJM), 5CO, 5CP, 5EA, 5EO, 5EW, 5FT, 5HY, 5IN, 5JJ, 5JP, 5KG, (5LB), (5MZ), 5NO, 5OQ, (5QC), 5QE, 5RQ, 5SP, 5TK, (5TY), 5UC, 5UI, (5VH), 5VW, 5WE, 5WE, (5WO), 5XE, 5ZAC, 8ZAD, (8ZO), 9AAW, 9ACN, 9AEG, 9AGR, 9AIR, 9AMA, 9AMI, 9AMT, 9AQM, 9ARZ, (9AVX), 9AWZ, 9AZE, 9BP, 9DCX, 9DKV, 9DMJ, 9DPB, 9DSO, 9DSZ, 9DZI, 9EV, 9GX, 9KI, 9LF, 9MC, 9MQ, 9OX, (9OA), (9UH), 9WD, 9WX, 9WY, 9YAK, 9YQ, 9ZA, Can. (3BA), (3BP), (3EI), (3FO), 3GE, 3KG, (3MO), (3PM), 3JJ, 9BJ.

C.W.—1AJP, 1ARY, 1AVR, 1BAS, 1BQE, 1BSD, 1BWL, 1CJZ, 1JP, 1QP, 1XM, 2AJF, 2AWF, 2BE, 2BML, 2CBW, 2FP, 2NZ, 3AJD, 3AQH, 3AQR, 3BAG, 3BEC, 3BM, 3BNM, 3CA, 3CC, 3CG, 3LE, 3OF, 3SJ, 4AS, 4BQ, 4BY, 4CO, 4DS, 4EV, 4FT, 4GL, 4ZC, 5FV, 5XA, 5ACF, 5ACM, 5AGK, 5AGO, 5AGR, 5AHK, 5AMF, 5ANR, 5APT, 5AQV, 5AWM, 5AWP, 5AXK, (5BBK), 5BDE, 5BDU, 5BK, 5BLT, 5BLW, 5BNE, 5BNY, 5BPM, 5BQL, 5BRL, (5BSF), 5BSS, 5BZB, 5BZY, 5CBJ, 5CG, 5DV, 5GE, 5HJ, 5JP, 5KU, 5LB, 5NB, 5OS, 5SE, (5ZM), 8ZX, 9AAS, 9AJP, 9AKR, 9BRK, 9DKY, 9DTA, 9FU, 9IO, 9QE, Can. 3BP, (3JI), 3SJ, 9AL.

**8ATN, Detroit**

Spark—2SZ, 2AHU, 2AJE, 3KG, 3TJ, 4BI, 4BQ, 4BY, 5FU, 5ZA, 5ZZ, 5XA, 9AR, 9YB, 9YC.



9YM, 9ACB, 9AOU, 9AYW, 9ARK, 9BLJ.

C.W.—1UQ, 1ZE, 1ANQ, 1AQJ, 1AJP, 1ARY, 1AWS, 1BKQ, 1BUA, 1CAK, 2BL, 2BP, 2CA, 2SV, 2TG, 2ZK, 2ANY, 2AQH, 2AJW, 2BEA, 2BEB, 2BIU, 2BLJ, 3BL, 3BG, 3BL, 3NH, 3RF, 3AJK, 3AQR, 3BEA, 3BHL, 3BRL, 4BQ, 4BY, 4DC, 4DS, 4ID, 4ZC, 4ZY, 5CH, 5LA, 5WO, 5ZA, 5X5, 5BK, 5DU, 5LF, 5LU, 5MG, 5OW, 5SP, 5XE, 5XK, 5ZA, 5ZR, 5ABO, 5AGO, 5ALM, 5AMM, 5ADG, 5AOZ, 5AWP, 5BBB, 5BED, 5BCI, 5BCF, 5BDB, 5BDU, 5BEF, 5BFX, 5BFZ, 5BGH, 5BRL, 5BRM, 5BUN, 5BZH, 5BZO, 5CAZ, 5CEE, 5CTZ, 5AW, 5EI, 5FQ, 5FZ, 5KP, 5WA, 5WV, 5AAW, 5AJA, 5AJK, 5AKD, 5AKR, 5ANQ, 5AOU, 5ARK, 5AYN, 5AYW, 5AJ, 5BBU, 5BEA, 5BBU, 5BED, 5BLO, 5BRL, 5CRL, 5DKY, 5DYN.

#### SBIL, Warren, Pa.

C.W.—1ADL, 1AJP, 1ARY, 7AZX, 1BDC, 1BEP, 1BGF, 1BKQ, 1BSD, 1BWJ, 1CA, 1COD, 1EZ, 1ON, 1PR, 1PT, 1QF, 1QP, 1RD, 1XM, 1YK, (2AAB), 2AJA, 2AJF, 2APQ, 2AU, 2AWF, 2AWL, 2AYI, 2AYZ, 2BDM, 2BEA, 2BGM, 2BJP, 2BML, (2BNZ), 2BQD, 2BQU, 2BRB, 2BSC, 2BTJ, 2BXP, 2BZU, 2CEC, 2CFI, 2CFT, 2CGO, 2EH, 2FP, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2SQ, 2WT, 2ZK, 3AAG, 3AAO, (3AAY), 3AFU, 3AJD, 3ALN, 3ANO, 3ANS, 3ANY, 3AOD, 3APD, 3AQF, 3AQH, 3AQR, 3ATZ, 3AVY, 3BA, 3BAG, 3BEC, 3BFG, 3BHL, 3BLF, 3BNU, 3BOF, Can. 3BP, 3BUR, 3BZ, 3CA, 3CC, 3HG, 3HJ, 3IL, 3IZ, 3KM, 3LR, 3NH, 3QZ, 3RF, 3RP, 3RY, 3SM, (3SQ), 3VW, 3ZC, 3ZY, 3ZZ, 4BF, 4BQ, 4BY, (4DC), 4DQ, 4DZ, 4EH, 4EL, 4EH, 4GL, 4ID, 4JB, 4LP, 4YA, 4ZC, 5AAM, 5DA, 5FV, 5HO, 5LA, 5NZ, 6XA, 5ADG, 5ADP, 5AGO, 5AHZ, 5AIO, 5AIS, 5AIZ, 5AJV, 5ALD, 5ALV, 5AMQ, 5AOG, 5AOU, 5AQF, 5AQR, 5AQV, 5AQZ, 5ARD, 5AWM, 5AWP, 5AWY, 5AWZ (fone), 5AXC, 5BDB, 5BDU, 5BEX, 5BFX, 5BGF, 5BK, 5BLT, 5BNJ, 5BQU, 5BUN, 5BVK, 5BYD, 5BZC, 5BZF, 5BZY, 5CAB, 5CKO, 5CG, 5GE, 5HJ, 5HM, 5IQ, 5NV, 5OW, 5PC, 5PT, 5SE, 5SP, 5VJ, 5VY, 5WY, 5ZAE, 5AAP, 5AAS, 5AAV, 5AAY, 5AIV, 5AJH, 5ARK, 5ASL, 5AWM, 5AYH, 5BLO, 5BRL, 5BSG, 5CKD, 5DAX, 5DOF, 5DV, 5DYN, 5EI, 5FM, 5FZ, 5HW, 5IO, 5KP, 5LE, 5PF, 5UC, 5WA, 5ZL.

Spark—1AW, 1HO, 1RV, 2AER, 2AHU, 2BFX, 2BJO, 2EL, 2FP, 2OM, 2RM, 2WB, 3AJD, 3AOW, 3APT, 3FB, 3HJ, Can. 3KG, 3QZ, 3YV, 4AG, 4BI, 4BQ, 4CX, 4DQ, 4EA, 4GN, 4AFD, 5AHH, 5AIZ, 5ARD, 5AXY, (5AYM), 5AYN, 5BAZ, 5BRL, 5BSY, 5CH, 5CHV, 5CP, 5EB, 5EW, 5FT, 5OD, 5OI, 5RK, (5TY), 5YR, 5AAW, 5ACB, 5AIR, 5ASJ, 5DCX, 5OX, 5UH, 5VL.

#### Leonard Strobel, Akron, Ohio

Spark—1AW, 2DN, 2FP, 2WB, 2WC, 3AJD, 3BCM, 3BM, 3NY, 3TA, 4AG, 4AK, 4AS, 4CX, 4EA, 4GN, 5BA, 5JD, 5AAS, 5ABA, 5ADQ, 5AFD, 5ALD, 5AOH, 5APD, 5ASY, 5AU, 5AUG, 5AWY, 5BAZ, 5BHV, 5BMP, 5BRL, 5CJ, 5CO, 5CP, 5EF, 5ER, 5EW, 5HY, 5IN, 5LB, 5LY, 5MG, 5MT, 5NO, 5RX, 5SP, 5TU, 5VA, 5VY, 5WL, 5XE, 5YN, 5ACB, 5ACM, 5AEG, 5AIR, 5AKM, 5ALA, 5ALO, 5AOU, 5AVL, 5AX, 5AZA, 5AZK, 5BIM, 5CP, 5DB, 5DEV, 5DYZ, 5DIW, 5DKY, 5DQ, 5DRP, 5DSO, 5DUX, 5DYZ, 5DZZ, 5GX, 5OX, 5VR, 5VW, 5WE, 5YA, 5ZB.

C.W.—1AJL, 1ALW, 1AOE, 1ASF, 1BAJ, 1BOL, 1BG, 1BGL, 1BKL, 1BKQ, 1CK, 1XAD fone, 1XM, 1YK, 1ZE, 2AAB, 2AWL, 2BB fone, 2BBB, 2BE, 2CA, 2CFT, 2CI, 2FP, 2HQ, 2OG, 2OP, 2SZ, 2UD, 2WT, 2WZ, 2ZK, 3AL, 3BD fone, 3BG, 3BHL, 3BVL, 3FW, 3GZ fone, 3AZ, 3ZY, 3ZZ, 4AAM, 4ADE, 4AX, 4BIY, 4BLF, 4BQ, 4BY, 4CM, 4CY, 4DF, 4DQ, 4EL, 4EU, 4FV, 4GL, 4GR, 4ID, 4XD, 4XQ, 4XY, 4XZ, 4YC, 4ZAB, 4ZC, 4ZZ, 5DA, 5DR, 5FV, 5GZ, 5MA, 5TU, 5ZL, 5ZW, 5ZZ, 5AB, 5ACF, 5AIM, 5AIV, 5AJ fone, 5ALV, 5AMU, 5ANX, 5AOG, 5APD, 5ARM, 5ARU, 5AW, 5AWY, 5AXK, 5BBK, 5BCM, 5BDO, 5BUM, 5BV, 5BYM fone, 5CP, 5DU, 5DV, 5OR, 5OW, 5QZ, 5RE, 5AZ, 5VY, 5WE, 5WR, 5XU, 5ZZ, 5AAP, 5AAU, 5AAV, 5ABA, 5ADB, 5AEZ, 5AKR, 5ALP, 5AMR, 5AMS, 5ARK, 5AW, 5AWB, 5AYU, 5BBF, 5BDP, 5BF, 5BP, 5BRL, 5BAX, 5DEW, 5DF, 5DJ, 5DP, 5DTA, 5DV, 5EI, 5FZ, 5IM, 5IO, 5KP fone, 5VL, 5VV, 5WK, 5WM, 5XW, 5YB, 5ZJ fone.

#### 5AGO, Pittsburgh—All C.W.

(111), 1QP, (1RD), 1XM, 1ZE, 1AZW, 1BUA, 1CAK, (1CMK), 2BG, 2FP, (2NZ), 2SQ, 2WI, 2WT, 2XQ, (2ZK), 2ZS, (2AAB), 2AJF, 2AMO, 2AQH, (2AYV), 2AWL, 2BAK, 2BEA, (2BEB), (2BEH), (2BFZ), 2BGT, 2BNC, (2BTJ), 2BYW, 2CCD, (3BA), 3BZ, 3CA, 3CC, 3CA, (3EM), (3FM), (3FS), 3GH, 3HC, 3HJ, (3IZ), 3JJ, 3KM, 3LR, (3QV), (3QZ), (3WW), 3XL, (3ZY), (3AAD), 3AAG, 3AAY, (3ADX), 3ANJ, (3ALN), 3APQ, (3AQH), (3AQR), 3ASO, 3ASW, (3BFS), (3BFU), 3BHL, (3BLF), 3BTK, 4AS, (4AZ), (4BF), 4BQ, 4BY, 4DQ, (4EU), 4FT, (4GL), 4IL, 4KC, 4LP, 4XD, (4ZC), (4ZE), 4YA, 5DA, 5EK, 5FV, 5HO, 5JB, 5NZ, 5PM, 5UU, 5WO, 5ZA, 5AAM, (5BO), 5ZZ, 6XAD, (5BK), (5BO), 5BU, (5GE), 5GW, 5HJ, (5IH), 5IQ, (5KH), 5PC, 5QB, (5SE), 5VJ, (5VY), (5UK), 5WY, 5ZG, 5ZZ, 5AAN, (5ADG), 5ADM, 5AGZ, 5AIL, (5AIM), 5AIS, (5AMD), 5AMF, 5ANC, 5AQZ, (5ARI), 5ARK, 5ARW, 5AVD, 5AVO, (5AWM), (5AWP), 5AWY, 5AXK, 5BBD, 5BCA, 5BEI, 5BEY, 5BFX, 5BGV, 5BLT, 5BLW, 5BOX, (5BRM), 5BUN, 5UX, (5BXA), (5BZY), 5CJX, (5CLD), (5DV), 5EI, 5FM, 5FZ, 5HW, 5HY, 5IF, (5IL), (5IO), (5IZ), (5KI), (5KP), 5LE, 5LQ, 5PS, 5PW, 5QE, 5SL, 5SO, (5UC), 5WA, 5WK, 5XI, 5ZE, 5ZG, 5ZL, 5AAS, (5AAV), 5AAY, 5AEQ, 5AJA, (5AJH), (5AKD), 5AMD, 5AMU, 5ANE, 5AOA, 5AQA, (5ARK), 5ARN, 5ASD, (5ATE), 5AYH, (5BED), 5BJB, 5BLC, 5BLO, (5BRL), 5DAM, (5DAX), 5DCF, 5DOF, 5DUN, (5DZQ), 5XAI, 5ZAE, 5CANadians (5BP), (5IZ), (5FO), 5AL.

#### 5XE, State College, Pa.

(1ADL), (1AHL), 1APP, (1AW), 1AWB, 1AX, (1AZW), (1BKQ), 1BIR, (1BOP), 1BWJ, (1CZ), 1HO, 1MB, 1MX, (1RV), 1SN, (1XM), (1ZE), (2AGC), 2AJW, (2AQI), (2BB), 2BGM, 2BK, 2BJO, 2BFF, 2BML, (2BRC), (2BUM), 2CT, 2EH, (2EL), (2FP), 2OF, (2OM), 2PR, (2RM), 2VA, 2WB, (2ZL), (3ABB), 3AIE, 3AJD, 3AK, 3ARD, (3ARR), 3AUW, 3BAG, 3BHL, 3BJJ, 3BLF, 3BP, 3BZ, 3CN, 3EH, 3EI, (3FB), (3FM), 3HAY, 3HL, 3HQR, 3IP, 3MB, 3QF, (3QZ), (3TA), (3TJ), 3UD, 3UQ, 3XA, 3XW, 3ZAB, (3ZO), (4AS), 4DS, (4DZ), (4EA), (4EL), (4GL), (4GN), 4JB, 5AAB, (5FJ), (5FY), 5GL, 5NH, 5SM, 5XA, 5XB, 5YG, 5YH, 5ZAF, (5ACF), (5AIM), (5AIT), (5ARD), (5AUE), (5AUY), (5AXE), (5AYN), (5BEP), (5BEJ, (5BHV), (5BFS), (5CHO), (5DZ), (5IH), (5JJ), (5PI), (5QE), (5SP), (5UC), (5WM), (5AAP), 5AJ, 5AJA, (5AQV), (5ASJ), (5AXG), (5AZA), 5BRL, (5CP), 5DAX, (5DGX), (5DLX), 5DQ, 5DRR, (5DWP), 5DY, (5FS), 5IO, 5KT, 5OF, 5MC, 5OX, (5UH), 5VL, 5VZ, (5YC), (5YE), (5XE), 5ZL.

#### 9ZJ, Indianapolis—Every District

Spark—2EH, 2OM, (3BP Can.), (3FO), 3KG, (3ZO), (3ZS), (4YA), 5EK, 5JD, 5KC, 5SM, 5QA, 5XA, (5XB), (5XI), (5XU), (5YE), (5ZAF), (5ZE), 5ZR), (5XQ), 7ZM, (5AGO), 5ARS, (5AXY), (5BRL), (5IN), (5LQ), 5MZ, 5OD, 5WO, 5XE, (5YAE), (5ZA), (5ZN), (5ZP), (5YU), 5ACB, 5AEY, 5AIG, 5AIR, 5AMS, 5AQQ, 5ASJ, (5AWU), (5AZE), (5BGP), (5BK), (5DXE), 5DZY, 5DMJ, 5GY, 5LF, 5OX, (5PB), 5RY, 5WU, 5WX, 5XAQ, (5XI), (5XM), (5YAE), (5YAJ), (5YAK), (5YB), (5YM), (5YQ), 5ZAF.

C.W.—1XM, 2BEA, 2BFX, 2BNZ, 2CCD, 2FP, 2FS, 2NZ, 3ALN, 3BG, 3BP Can., (3HJ), 3XW, (3ZO), (3ZY), 4CY, (4FT), 4GL, 5EK, 5ND, (5ZA), 5ZG, 5ZZ, 5AGO, 5AIO, 5ANJ, 5ARK, 5ARW, 5AVD, 5BBU, 5BCL, 5BDD, 5BK, 5BNJ, 5BO, 5XX, 5CBJ, 5CQS, 5DV, 5QZ, 5UK, 5UY, 5VY, 5WO, 5XE, 5YD, 5ZZ, 5AAS, 5AJA, 5AKR, 5AMO, 5BRL, 5DOF, 5FD, 5IL, (5RV), (5XM), 5ZAF, 5ZG.

#### 9APK, Chicago—Every District

Spark—(1ARY), 1XM, (2BJO), (2BK), (2FP), 2JZ, (2OM), 2PV, (2ARB), (3AJD), (3ALN), 3XM, (3ZA), 4CG, (4DH), 5AQ, (5BY), (5HK), (5JD), 5LO, 5IR, 5IF, 5PE, 5PG, 5QZ, 5QS, 5SM, 5FO, 5FV, (5NS), 5XA, 5XU, 5ZE, 5LC, (5XAG), (5KG), (5MP), (5ZV), 7ZU, 5ABO, (5AFA), 5AFD, (5AID), 5AIO, (5AIT), 5AOI, 5APP, (5ARD), 5ARS, (5AVO), (5AVT), (5AWU), 5AVH, 5AXY, 5AYE, (5BBU), (5BBY), (5BCO), 5BDV, (5BDY),

8BEF, (8BEN), 8BEP, 8BFM, (8BFX), 8BFY, 8CAY, 8CGY, (8CP), 8EA, (8EB), 8FA, (8FT), 8FZ, 8GA, (8JJ), 8KY, 8LB, 8RM, 8RQ, (8UC), 8WD, 8WO, 8BBX, (8BXC), (8BXX), 8YR, 8BQC, 8BOI, 8XE, 8YN, 8ZAA, 8ZAC, (8ZF), 8ABV, 9ACB, (9ACL), (9ACP), (9ADI), 9AEG, 9AEF, 9AIF, 9AIG, 9AIP, 9ALP, (9ALU), 9ANO, 9ANP, 9AOJ, (9APS), (9AQZ), (9ARG), 9ARZ, (9ASJ), (9ASK), (9AUA), 9AVK, 9AVZ, 9AYH, 9AYW, 9AZE, (9BCF), (9BIJ), 9BDJ, 9BMN, 9BRT, 9BSA, (9DEH), 9DBY, (9DGV), (9DGW), 9DGX, (9DHz), 9DKQ, (9DNC), (9DPB), 9DHH, 9DSW, 9DAG, 9FK, (9HR), 9JN, 9KA, (9MS), (9OA), (9OX), 9RY, (9UH), 9XT.

C.W.—1BKQ, 1COD, (2FP), 3ALN, 3ALR, 3AJD, 4CO, 4BQ, (6ZZ), 8AGO, (8AIO), 8AQV, 8AWM, 8AWP, 8AXK, 8BBK, (8BLW), 8IQ, 8BRL, 8BSS, 8BYR, 9AOG, 9BDV, (9DTA), 9ADI, 9QE, (9XI), 9ZAF, 9ZL, 8QB.

### 9BBE, LaSalle, Ill.

C.W.—1RU, 1XM, 1AFV, 1ARY, 1BCG, 1CAK, 2DN, 2EL, 2FD, 2FD, 2FP, 2FT, 2KP, 2UF, 2WF, 2WL, 2XB, 2ZL, 2ZL, 2ZL, 2AAX, 2AWL, 2BGM, 2BML, 3AM, 3DH, 3FB, 3FT, 3IW, 3LR, 3MO, 3QZ, 3XM, 3ZO, 3AAB, 3AEV, 3AHK, 3AQR, 3ARN, 3BLF, 4BA, 4BF, 4BK, 4BQ, 4CC, 4CO, 4CX, 4EL, 4FT, 4GL, 4NX, 4SS, 4ZC, 4ZO, 5FV, 5HO, 5JD, 5LA, 5NK, 5NZ, 5RZ, 5UU, 5XB, 6ZZ, 6BK, 6CI, 6DX, 6GE, 6HM, 6HP, 6II, 6IQ, 6JQ, 6LF, 6LU, (6LX), 6NQ, 6NX, 6OH, 6QZ, 6RQ, 6SP, 6UJ, 6VJ, 6VY, 6WR, 6XE, 6XK, 6XV, 6ZG, 6ZZ, 8ABV, 8AEG, 8AGZ, 8AIO, 8AIM, 8ALE, 8AOA, 8AOD, 8AQF, 8AQV, 8AWP, 8AWZ, 8BCI, 8BDU, 8BEF, 8BFX, 8BNE, 8BOW, 8BOX, 8BRK, 8BRK, 8BXA, 8ZAE, 9EL, (9HK), (9IF), 9IO, (9JL), 9KP, 9LQ, 9PI, 9PS, (9QE), 9RM, 9WA, 9WT, 9XD, 9YB, 9ZG, (9ZL), 9AAP, 9AAS, 9AAV, 9AAY, 9ABU, 9ACB, 9AJA, (9AJH), 9AKD, 9AKR, 9AMB, 9ANE, 9AQR, 9ARK, 9ASL, (9AYS), 9BAC, 9BAP, 9BBF, (9BEO), (9BFH), 9BIZ, 9MB, (9BUH), (9DBV), (9DCR), 9DDY, (9DKH), 9DTA, 9DYE, (9DYN), 9DZW, 9XAC, 9XAM, 9YAM, Can. 3BF, 9AW.

Spark—1AW, 1DJ, 1SN, 1TS, 1AKG, 1AWZ, 2BK, 2EL, 2OM, 2RU, 2WB, 2WL, 2AJW, 3AC, 3AM, 3DH, 3DM, 3EL, 3HJ, 3IW, 3MS, 3UC, 3ZO, 3AQR, 4BE, 4BQ, 4CX, 4DH, 4FD, 4GN, 4JB, 5AA, 5AF, 5AI, 5BY, 5DA, 5DU, 5ED, 5EG, 5EK, 5ER, 5EW, 5FJ, 5FO, 5HK, 5IS, 5JD, 5MF, 5PY, 5QA, 5QS, 5SR, 5TD, 5TG, 5UU, 5XA, 5XB, 5XI, 5XJ, 5XM, 5XS, 5XU, 5YI, 5YL, 5ZA, 5ZL, 5ZS, 5ZW, 5ZX, 5ZZ, 5ZAB, 5ZAK, 5BP, 5CP, 5DW, 5EA, 5EB, 5ER, 5EW, 5FI, 5FK, 5FN, 5FT, 5GO, 5HG, 5HM, 5IN, 5JJ, 5KS, 5LH, 5LJ, 5MR, 5NZ, 5OI, 5PO, 5QA, 5QZ, 5RU, 5SP, 5TK, 5TT, 5UC, 5WI, 5XE, 5XS, 5YN, 5YT, 5ZD, 5ZN, 5ZP, 5ZR, 5ACF, 5ACN, 5ACR, 5AFB, 5AFD, 5AFF, 5AFK, 5AGK, 5AGO, 5AHH, 5AIB, 5AJX, 5AMD, 5AMZ, 5ANO, 5ARD, 5ARS, 5ATU, 5AWP, 5AYN, 5BBU, 5BEP, 5BNA, 5BRL, 5BUN, 5DBO, 5ZAA, 5AP, 5AU, 5BE, 5BF, 5BP, (5CA), 5CP, 5CS, 5EE, 5EL, 5ET, (5FK), 5FS, 5GC, 5GP, (5HK), 5HM, 5JN, 5JM, 5KO, (5KY), (5LF), 5LW, 5MC, 5ME, 5MF, 5MS, 5NQ, 5OX, 5PN, 5PS, 5RC, 5TL, 5UH, 5UJ, 5VM, (5VW), 5XI, 5YA, 5YB, 5YC, 5YD, 5YO, 5ZZ, 5ZN, 5AAP, 5ABL, 5ACB, (5ACL), 5ACN, 5AEG, 5AEQ, 5AET, 5AFF, 5AFK, 5AGN, 5AGR, 5AHE, 5AIC, 5AIG, 5AIR, (5AJH), 5AJZ, 5AMA, (5AMR), 5AMS, 5AMT, 5ANO, 5AOU, (5APB), 5APK, 5APQ, 5AQE, 5ARZ, 5ASH, 5ATV, 5AUA, 5AUH, 5AWX, 5AYW, (5AZA), 5AZF, 5BBU, 5BCX, (5BDF), 5BHE, 5BHM, 5BHO, 5BIC, (5BIJ), (5BJA), 5BJT, 5BSA, (5BSC), (5BSJ), 5BSO, (5BTA), (5BUO), (5BYF), 5BYM, 5DBU, 5DEH, 5DEU, (5DEV), (5DFX), (5DHD), (5DHz), 5DIG, 5DKV, 5DLX, 5DMP, 5DMW, 5DPQ, (5DQR), 5DQD, 5DRJ, (5DRN), 5DSO, 5DUG, 5DWP, 5DXI, 5QXA, 5DYU, 5DYK, 5DZQ, (5DZU), 5DZL, 5TTI, (QRA? PSE), 9YAK.

### 9AHC, Ellendale, N. D.

C.W.—1ARY, 1XM, 2FD, 4AZ, 4EH, 4TD, 4YA, 5DQ, 5EK, 5FV, 5HO, 5KP, 5LA, 5MT, 5OI, 5ZA, 5ZAC, 6KA, 6XAQ, 6ZZ, 7ZU, 8ABO, 8AGO, 8AJV, 8AM, 8APT, 8APV, 8APQ, 8AQV, 8ARD, 8ARW, 8AVO, 8AWM, 8BDU, 8BFX, 8BLW, 8BNJ, 8BO, 8BOX, 8BRL, 8BSS, 8BZC, 8BZY, 8CAZ, 8CFS, 8CJX, 8CX, 8HM, 8HZ, 8IQ, 8JL, 8LX, 8MP, 8OS,

8OW, 8OZ, 8QM, 8UK, 8VY, 9AAP, 9AAV, 9ACB, 9ADF, 9AEG, 9AFB, 9AIF, 9AJA, 9AJH, 9AJP, 9AMB, 9AMU, 9ARK, 9ARZ, 9ASF, 9ASL, 9ATE, 9WL, 9AWM, 9AXF, 9AYS, 9AZH, 9BAF, 9BBF, 9BED, 9BGH, 9BJB, 9BJI, 9BLO, 9BP, 9BRL, 9BSG, 9BTT, 9BUM, 9BCF, 9BYF, 9CAO, 9DCF, 9DCW, 9DGG, 9DKY, 9DOF, 9DQM, 9DTH, 9DTM, 9DV, 9DVL, 9DX, 9DXN, 9DYI, 9DZQ, 9EW, 9FM, 9FZ, 9HT, 9IF, 9IL, 9JG, 9PC, 9PI, 9PS, 9QD, 9QE, 9SL, 9SO, 9VE, 9VK, 9WA, 9WK, 9XAQ, 9XI, 9YF, 9ZE, 9ZL, Canadian 8BP and 4CB.

Fone—9AG, 9AKX, 9ASF, 9BNO, 9PI, 9RZ, 9XAQ.

Spark—5EW, 5FO, 5HK, 5HZ, 5IF, 5LB, 5LO, 5NK, 5NS, 5PE, 5QL, 5SM, 5XB, 5XD, 5XU, 5YG, 7MP, 7XB, 7ZV, 8AY, 8AYN, 8BEP, 8BFH, 8LB, 9ABV, 9ACB, 9ACN, 9AEG, 9AEY, 9AFK, 9AFW, 9AGR, 9AHZ, 9AIG, 9AMI, 9ANF, 9ANP, 9ANQ, 9AOJ, 9AOU, 9APN, 9AQN, 9ASF, 9ASK, 9ASM, 9ASF, 9ATN, 9AUA, 9AUL, 9AVX, 9AVZ, 9AWZ, 9AXU, 9AYW, 9AZA, 9BGX, 9BHG, 9BMN, 9BOF, 9BRI, 9DEH, 9DEU, 9DJX, 9DKS, 9DPB, 9DSD, 9DUG, 9DUI, 9DXS, 9DXW, 9DZY, 9FX, 9GC, 9HI, 9IY, 9KI, 9LF, 9LW, 9MC, 9MS, 9OF, 9PI, 9RC, 9RY, 9SN, 9TI, 9UG, 9VL, 9WI, 9WY, 9XAI, 9XT, 9YAE, 9YAJ, 9YAK, 9YAL, 9YB, 9YQ, 9ZB, 9ZC, 9ZJ, Canadian 8GN.

### Rev. 9AOR, Pequot, Minn.

C.W.—4FT, 5BQ, 5DD, 5EK, 5HO, 5KP, 6XO, 6XAD, 7HH, 7WE, 8AIM, 8AWG, 8AXK, 8BCA, 8BEX, 8BFX, 8BGA, 8BH, 8BO, 8BOX, 8BSS, 8CFS, 8II, 8LY, 8PN, 8RQ, 8UK, 8VY, 8WI, 8XAE, 8ZZ, 9AAI, 9AAP, 9AAU, 9AAV, (9ABB), 9ADF, 9AEG, 9AFB, 9AFK, 9AGN, 9AJA, 9AJH, (9AJP), 9AJS, 9AKD, 9AKK, 9AKR, 9ALE, 9AOU, 9AQQ, 9ASF, 9ATE, 9ATX, (9AUA), 9AUM, 9AVM, 9AWM, 9AWP, 9AXK, 9AYR, 9AYU, (9BAF), (9BAV), 9BBF, 9BDO, 9BDU, (9BED), (9BFG), 9BGH, 9BIO, 9BII, 9BJV, 9BLW, 9BOW, 9BRL, 9BSG, 9BUM, 9DB, 9DCS, 9DFA, 9DFX, 9DG, 9DGE, 9DQG, 9DHA, 9DHC, 9DIG, 9DIM, 9DKY, 9DOF, 9DQM, 9DSG, 9DSW, 9DTH, 9DTM, 9DTS, 9DV, 9DXS, 9DYT, 9DZJ, 9DZQ, 9DZY, 9EI, 9EW, 9EX, 9FM, 9FW, 9FZ, 9HW, 9IL, 9IO, 9JL, 9KP, 9LJ, 9LL, 9LQ, 9NV, 9PI, 9PS, (9QE), 9SL, 9SW, 9UC, 9VK, 9VY, 9WQ, (9WU), 9WX, 9XI, 9XAQ, 9YAE, 9ZG, 9ZL.

Spark—5IS, 5JD, 9AAW, 9AEY, 9AIG, 9AIM, 9ANQ, 9ARZ, 9ARR, 9ASK, 9ATN, 9AUA, 9AVX, 9AVZ, 9AWZ, 9AXR, 9AYS, 9AZA, (9BAL), 9BIZ, 9BXC, 9DES, (9DGV), 9DIH, 9DKS, 9DNC, 9DSO, 9DZY, 9W, 9MF, 9XT, 9YB, 9YM, 9YAC, 9YAJ, (9YAK), 9ZC.

### 9DPX, St. Paul, Minnesota

Spark—5AQ, 5EW, 5FO, 5HK, 5IF, 5JF, 5LB, 5NY, 5PU, 5SM, 8BBU, 8BXX, 8BG, 9HI, 9KI, 9LW, 9MC, 9MS, 9NQ, 9OA, 9OI, 9SN, 9VL, 9WI, 9WT, 9ABV, 9ACB, 9AEG, 9AFK, 9AGR, 9AHZ, 9AIF, 9AIG, 9AIK, 9ALO, 9AOJ, 9ASO, 9ATN, 9AUU, 9AVZ, 9AWZ, 9AXU, 9AYW, 9AZH, 9BRL, 9DCX, 9DEL, 9DFX, 9DJX, 9DKQ, 9DKS, 9DNC, 9DSO, 9DSO, 9DZI, 9DZJ, 9DZY.

C.W.—2XQ, 2BEA, 3BQ, 3AQR, 4BQ, 5EK, 5FV, 5HO, 5LA, 5NZ, 5OI, 5DV, 5GE, 5IO, 5MP, 5OS, 5OW, 5UK, 5WA, 5ABO, 5AIO, 5ALB, 5AMM, 5ANC, 5AOG, 5APT, 5AWM, 5AXK, 5BBX, 5BCO, 5BDU, 5BEF, 5BNJ, 5BUM, 5BXA, 5BZC, 5CFS, 5CGM, 5ZAE, 5EW, 9FZ, 9HW, 9HY, 9IO, 9KP, 9LQ, 9PS, 9QE, 9WA, 9ZE, 9ZG, 9ZL, 9AAP, 9AAV, 9AY, 9ABF, 9AIN, 9AJA, 9AKD, 9AOR, 9ARK, 9ATE, 9AWM, 9AYH, 9AYS, 9AZF, 9BAF, 9BBF, 9BED, 9BGH, 9BJB, 9BLO, 9BNO, 9ONE, 9BUM, 9DCR, 9DFL, 9DKY, 9DOF, 9DSM, 9DTS, 9DUN, 9DYN, 9DZQ, Canadian 3BF, 4CB.

### 9APW, St. Paul, Minnesota

C.W.—1ARY, 2FP, 3AQR, 3ZO, 3ZOV, 4BQ, 4FT, 4ZC, 4CY, 4BY, 5EK, 5ZA, 5LA, 5VR, 5UU, 5OI, 5ND, 6ZZ, 6XAD, 6ZF, 7HW, 8BE, 8DV, 8SP, 8VJ, 8VY, 8XV, 8ZZ, 8AGZ, 8AIM, 8AOG, 8APT, 8AQF, 8AWM, 8BDO, 8BLW, 8BFX, 8BUM, 8CAZ, 8CFS, 8CGM, 8ZAE, 9BY, 9DB, 9DK, 9FM, 9HW, 9KP, 9IO, 9JL, 9PI, 9RY, 9WU, 9ZY, 9ZX, 9ZR, 9ZL, 9VK, 8YQ, 9YF, 9AX, 9AAP, 9AAV, 9AAO, 9AAY, 9AOU, 9AAS, 9AJA, 9AJS, 9ATN, 9AVM,

(Concluded on page 67)



# Amateur Radio Stations



## 5HK, Oklahoma City, Okla.

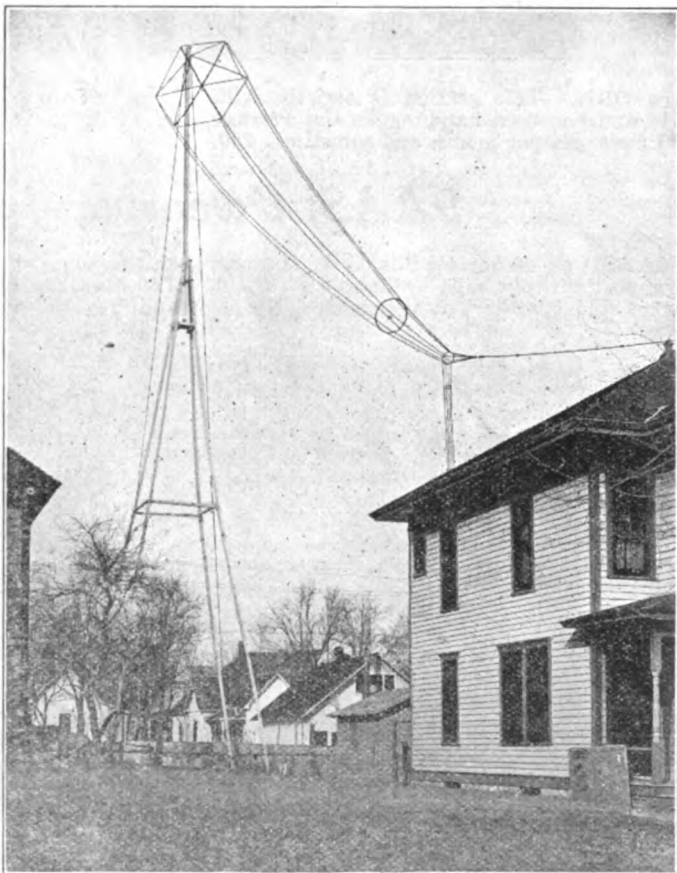
The spark set 5HK of Le Roy Moffett, Jr., at 312½ North Broadway, has been heard in nearly all states. The picture shows a selection from over 600 cards and letters he has received since September.

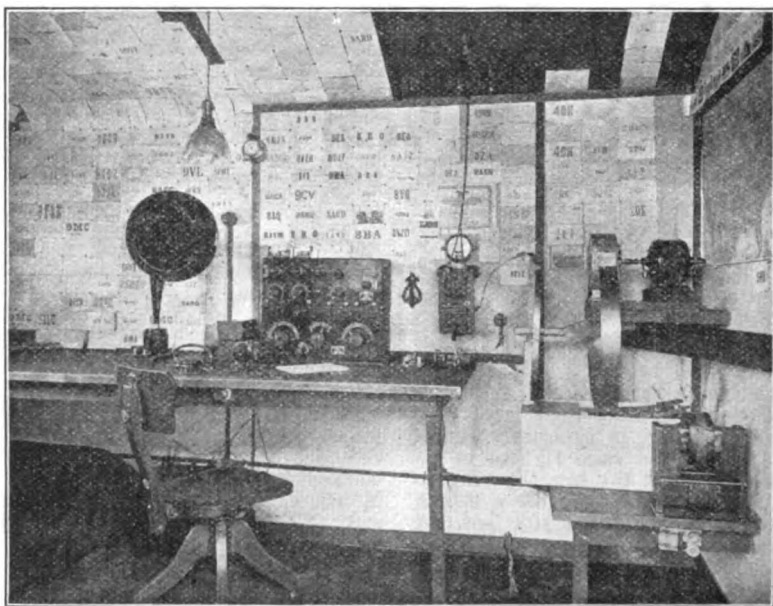
The antenna system is especially interesting. The aerial is a cage 12 feet in diameter, 93 feet high at the top, tapering to a bottom 3 feet in diameter with a 9-inch lead-in, the total length being 105 feet. A counterpoise is used, fanning out 80 degrees and covering all of the yard back of the shack and the yard to the left of the picture.

The transmitter has proven very efficient. The transformer is a 1 K.W. Acme. The condenser is a HE one and stands the gaff OK. It is an oil-immersed affair composed of 58 copper plates each separated by four 8-by-10 photo plates. The primary is a single turn of 2½ inch copper ribbon 22 inches in diameter and the secondary is made of 24 feet of ¼ inch strip. The gap is a Benwood eight-toothed driven by a variable speed motor, but as shown theoretically elsewhere in this issue the low tone is found to be best. We like this arrangement of the closed circuit, with the single-turn primary cut at the bottom for the condenser and at the top for the gap. Leads are minimized and the greatest efficiency secured thereby. With constant effort an antenna current of seven thermocouple amperes has been obtained.

The receiver is a Z-Nith regenerative with two steps of audio amplification, Baldy phones, Magnavox, W.E. and A.P. tubes.

5HK has been reported QSA from Boston, Mass., Seattle, Wash., Eugene, Oregon, Canada, and the Isle of Pines. He has worked 8RQ in Pennsylvania, 7ZU in Montana, and 6XAD in California. A 100 watt C.W. set will be going shortly to work





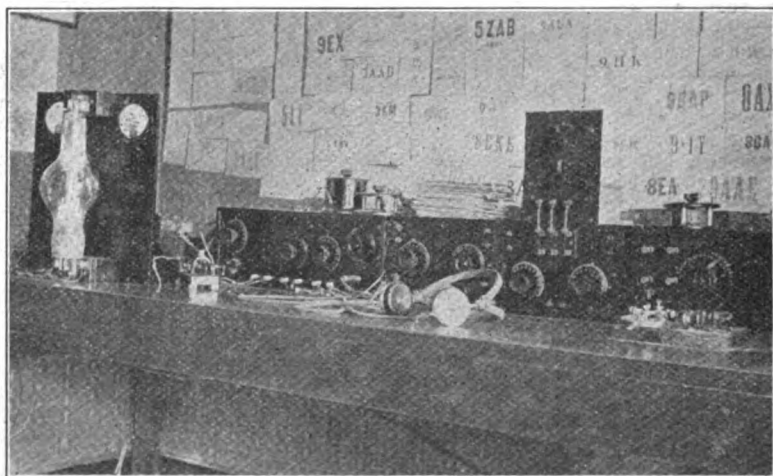
thru QRN. This station is strictly A.R. R.L. and has been handling on the average 100 messages per month and sometimes 200.

If school work didn't cause so much QRM he would probably QSR more.

## ***9AAS, Owensboro, Ky.***

9AAS, one of our leading C.W. stations, is almost entirely built by Robert W. Field, owner and operator, at Owensboro, Ky.

on the house, the flat top being 90 ft. long. The counterpoise is 12 ft. from the ground and has the same length and number of

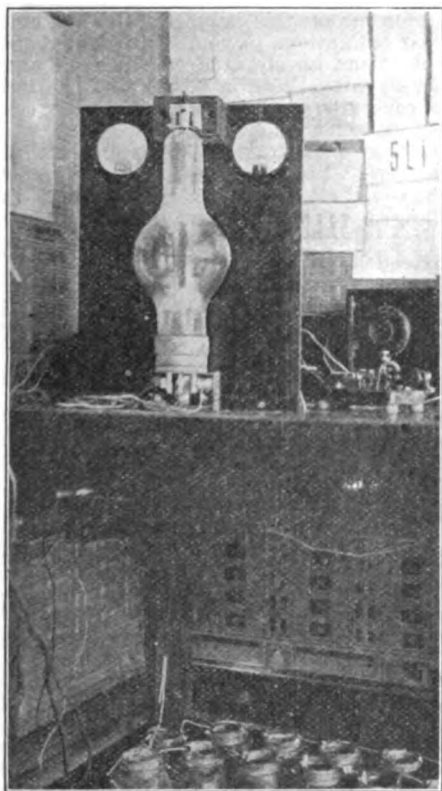


The antenna is a nine wire inverted L supported 70 ft. high at one end by a persimmon tree and 60 ft. high by a pole

wires as the antenna:

The transmitter has just been changed from a 50 watt tube to a 250 watt U.V.204

with the result that cards have been coming in faster than it is possible to answer. The circuit used is similar to number nine in the Radio Corp's C.W. catalogue except that only one tube is used. Except for the tube, grid leak, and condensers, nearly all the set is home-made. The power transformer has the low voltage filament winding directly over the primary. The high voltage winding is on the other leg and delivers 2200 volts on each side of the mid-tap. The rectifier consists of 36 quart fruit jars although 26 seems best as it



gives better radiation due to lower resistance. The elements are of aluminum and lead, aluminum wire has been found satisfactory in every way for the aluminum electrodes, used with a saturated solution of borax. With  $9\frac{1}{2}$  volts on the filament the antenna current is  $3\frac{1}{2}$  amperes. Some trouble was experienced at first in getting the tube to run without overheating but it now runs fairly cool.

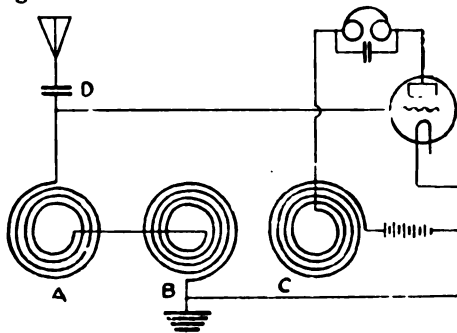
The receiver is regenerative with detector and two-step, all home-made. For plate voltage an 80 volt lead plate test tube battery is used.

9AAS has been reported in every district but the sixth, including Canada, and is an example of an excellent station where most

of it is home-made. The cost of such a station about equals the best one k.w. spark set and there is not a particle of doubt but that it is better.

## A Two-Control Tuner

ONE of the entrants in the S.W. Smith Cup Contest described a novel short wave tuner proposed by Mr. J. E. Parker, 3XK, which was used at 3AB1 in Washington with marked success. During the transcontinental relays the No. 1 west-bound message was followed until it reached the Sixth District, 5ZA being copied solid at a time when no other Washington station could hear him at all.



It is equally applicable to spark and C.W., and its performance is said to be greatly superior to all the usual varieties of single-circuit tuners. It is simplicity itself, A, B, and C being the three coils of a Turney "Spider-Web" Tuner, mounted on swinging doors. There are but two controls. A and B serve as a hinged variometer, B being the fixed coil and all tuning being done by swinging A. C is a tickler coil and regeneration and oscillation are controlled by swinging the door carrying it.

At 3AB1, on an average amateur aerial, when fixed condenser D had a capacity of 0.001 mfd. the wave length range of this set was from 150 to 240 meters.

Try it.

## ALL OUT OF MARCH

The great demand occasioned by the publication of the improved Reinartz tuner in our March issue has completely exhausted our supply of that number. However, we have a limited supply of June, 1921, issue, in which complete information was given on the original tuner, hundreds of which are giving splendid performance in amateur stations. While they last, 20 cents the copy.

QST, 1045 Main St., Hartford, Conn.

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility  
for statements made herein by correspondents.



## Telegraphy's the Thing

Dayton, Ohio.

Editor, QST—

Your editorial in March 1922 QST was read with much interest.

In dealing with the subject "Phones and Amateur Radio" it seems that an important point has not been brought out. What is the chief use of radio communication, anyway. I think it is the transmission of intelligence from point to point in the least possible time. Right here, we of the "TELEGRAPHERS" group, have a powerful argument. The long years of successful commercial traffic carried on by the Western Union and Postal Companies has proven the superiority of the telegraph over the telephone for the ACCURATE transmission of intelligence. The A.R.R.L. is altogether for the RAPID transmission of messages, and that is the fundamental usefulness of radio telegraphy.

The radio telephonists, both the listening classes and the transmitting classes even including the commercial broadcasting stations have no claim to actual utility, they only have popular support. They cannot argue that it is necessary, for instance, to transmit music from Pittsburgh to some distant point instantaneously. Even the lectures which are transmitted have no urgency demanding their transmission in a short space of time. I do not think the radio telephone has any logical claim to the ether, and I think our government should be made to see this point.

Let's use this powerful argument in furthering our interests: That radio communication has its greatest value in the rapid transmission of intelligence. The amateur relay men and commercial telegraphs should have preference over the phones.

Yours for RADIO TELEGRAPHY,

Paul R. Fenner,

Director, Dayton Radio School,  
Former Editor Pacific Radio News.

## Arc-Light QRM

Philadelphia, Pa.

Editor, QST:—

I am a regular subscriber to QST. I have searched every month through it for some data on the elimination of arc light induction but so far I have been disap-

pointed. I will give you the conditions under which I labor and if you in your next issue will print something which will enlighten me on this subject I shall be under great obligations to you. I live about three doors from an elevated car line and under this elevated there is a string of arc lights on each side with a space of about thirty feet between each arc. My aerial, which is a four wire flat top, is parallel with this arc line. I was using a crystal detector when I first heard this noise and then changed to a regenerator and tube detector thinking I could eliminate this noise. Instead it came in louder and at a friend's suggestion I shunted a variable condenser from the ground to the B Battery. This also did no good. I then erected an aerial at right angles to the arc line but this also was useless. I now started to get at my ground. I had been using buried chicken wire for a ground and I tried the radiator and then a tin roof but it did not make the slightest difference. I am at the end of my resources and look to you for help.

Thanking you in advance, I remain  
A Very Disheartened Ham.

(We regret to say that we do not know an effective way of getting around this trouble—and it has kept many a good station quiet for a season at a time. Does anybody know any way around it? If so, please let us have the dope at once, for publication. Some hope is held in the balancing-out scheme, whereby a second aerial or perhaps preferably a loop would pick up additional arc-QRM and couple it into the tuner in the reverse direction from the regular aerial, thereby cancelling out the QRM and leaving the signals collected on the main aerial. Anybody tried this with success? Help!—Ed.)

## Rotten Routing

90 Mountain Ave.,  
Summit, N. J.

Editor, QST—

In reading a letter of Staff Sgt. Walkeen, published in January QST, I noticed that he says one should QSR a msg. to keep it going. That is very good as far as it goes but it seems to me that too many amateurs

QSR just to keep the msg. going and not to get it to its destination. The lack of judgment shown in relaying some msg's. is appalling. I have QSR'd east and hrd the msg. come back from the south a week later to another station in the same town. It might better to delay a msg. a short time rather than QSR in the wrong direction just to get rid of it. Many a msg. never gets to its destination because it goes around in circles until someone gets wise to the fact that the information in it is too old to be any good and therefore throws it in the waste paper basket.

Most of this trouble could be remedied by a little thought and possibly the use of a map.

73, CUL.

Leonard Richards, 2AFR.

### Keep Your Eyes Open

Lebanon, Ind.

Editor, QST—

List to my sad tale. Honest,—I've got a real kick coming this time. It isn't often that I get peeved enough to want to break into print, except of course, when something begins to interfere with the great old game, radio.

Now I honestly believe that the radio manufacturers are going to queer this kitty of ours unless we rise up wrath and get the wouff houw to working. The case in point is this—No long since a prominent radio man, sales manager of an eastern manufacturing concern of long standing, came to Indianapolis and indulged in a speech the substance of which may be summed up as follows—The people who are putting in expensive radio sets to receive wireless music do not want to hear this dah-de-dah stuff—they are not going to take the time to learn the code—and, if interfered with, are going to raise considerable protest.—Thus, unless the amateur lays off between the hours of 6 and 11 P.M., he will simply be legislated out of existence.

For the past ten years his firm, and all the rest of 'em, depended upon me and the hundred thousand other dah-de-dah amateurs to keep them going. The amateur made possible the development of the apparatus we have today, and some of our best designers come from that same gang. But, now that the manufacturers have a new and extremely gullible field for their operations, we are going to be "legislated out of existence very promptly".

Laying aside the fact that, this attitude makes us peevisish, let's see if there isn't a solution to the problem:—

The amateur has a definite place in this scheme of affairs. Wouldn't the Signal Corps be in aheluvafix with this Radiola gang for ops? And everybody enjoys the concerts, for some really worth-while music is being sent out. I don't mean this Vic-

trola stuff that we have to stand for most of the time, though.

Thus why can't the manufacturers build a set for the amateur that works from 100 to 300 meters, and another for the Radiola outfit that responds to the band of wave lengths between 600 and 1,000. The unused section between 600 and 1,000 meters would be very satisfactory for radio music, and any amateur can get it after about three minutes work connecting a honey-comb coil. There is plenty of room for both of us, so let's stop this impending fight right now before it is too late. Otherwise it will mean the scrapping of a lot of apparatus.

Whenever an amateur game of any kind is commercialized, it is promptly relegated to the scrap heap. So let's get busy and start something.

Sincerely,  
Bayard Shumate, 9KR.

### Welcome Brother

326-18th St.,  
Toledo, O.

Dear QST:—

I am a new reader or your magazine and get a devluvolot of amusement out of it. But I want to tell you how I feel about all this.

I first became interested in radio through radio music (?) and having been a professional musician for the past eighteen years I naturally became interested in the possibility of home folks enjoying good music at home. I purchased a number of radio magazines among which was QST and it goes without saying that I soon felt my lack of enlightenment on radio most keenly. Asking for some information at a local supply concern I was advised to cultivate the acquaintance of someone who knew and little by little I would pick it up! That is like that famous bit of advice: "Send your boy to college and the boys will educate him."

I bought books on the subject only to find that they were so mathematical that I could get little out of it, it having been some 20 years since I looked a quadratic in the face.

I had just begun to feel this was a cold, cold world and that you just had to know before you could understand what anyone was trying to tell you about radio and O joy, QST comes out with "Getting Started Listening" in the March issue. I read and understood every word of it. No, I know that it is not explanatory of the principles of wireless which I so much crave but it is something. Just give me time and I will get the principles. Just give me time and I will come to the point in this letter.

I started this thing interested in fone only, and was willing to listen to most anything so long as it came over the ether. But drivel is drivel and doubly so when it comes over the radiophone. Occasionally



some worth-while stuff comes over the wire-less fone but 90% of it is worse than garbage from a musical festival. Being a musician, I detest jazz. When a person learns to appreciate—that is, listen to—music he no longer cares for jazz. Some folks prefer bologna to sirloin; folks with the same comparative musical tastes demand jazz, and get it, worse yet, *by way of radio*.

So I have lost interest in fones and want to learn all I can about telegraph receiving and transmission. Dear QST, couldn't you find space for a little information each month for us who want to know about radio and—there are thousands of us. Slip the mathematics to us gradually and we will assimilate in small doses.

Very truly yours,

Ben F. Boyer.

### Back to Earth

Norfolk, Va.

Editor, QST—

In reading over the January number of your valued paper, "QST", I note the following under "Strays":—

"Recent news service pictures show a cow-person on horse-back with a portable radio set, overhead antenna, etc., all prepared to round up stray cattle. The thing that bothers us is what do they do for a ground—have a binding post in the horse's side?"

I imagine you have had many restless nights, pondering over this deep problem, and thinking that perhaps you might be relieved by any solution, good, bad or indifferent, may I suggest that the ground lead be attached to the horse's (g)irth? It is only a simple problem in mathematics to subtract the "g".

Being an ex-Signal Corps man, I once had the pleasure (?) of "spilling over" one of the brutes referred to, and while I found the transmitter was very efficient a highly-damped ground offered poor reception. I am for hooking the antenna to the bridle and the ground lead as suggested above.

With kind regards, I am,

Yours truly,  
R. I.

### A Spark Coil C.W. Set

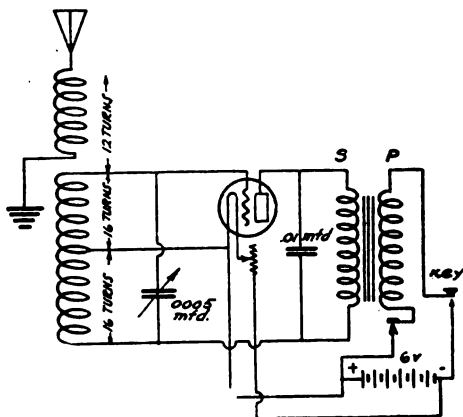
2065 Belmont Ave.,  
Bronx, N. Y.

Editor, QST—

QST readers may be interested in my spark coil C.W. set. A diagram is here given.

I have found by experiment that inductive coupling will give better results than conductive coupling on a set of this type. By putting a 2 volt flash light bulb in the antenna circuit, the set can easily be adjusted to resonance. The apparatus needed is a Quaker Oats tube or any other 4 inch tube, a roll of insulated annunciator wire, a .0005 mfd. variable condenser (a

small Murdock is just right), a U.V.201 amplifier tube or any other hard tube operating off 6 volts, a rheostat, a  $\frac{1}{2}$  or 1 inch spark coil, a .01 mfd. fixed mica condenser to lower secondary voltage and pass high frequency.



Twelve turns are wound at the top of the tube for the antenna inductance. A space of 2 inches is left and the grid-plate coil is wound. This consists of 32 turns with a tap at the center. The only tuning element is the variable condenser. If the set does not oscillate then reverse the connections to the primary of the spark coil. A toy step-down transformer can be used to light the filament.

With this set I have no trouble working 55 miles daylight. This set can be used to radio-phone 1 mile if a microphone is placed in primary of spark coil and the vibrator tightened.

Samuel Kopelson,  
2BFC.

### Rotten Msg.-Delivery

2111 So. Franklin St.,  
Denver, Colo.

Editor, QST—

Being a very enthusiastic amateur and working for the success of amateur radio, I am taking the privilege of expressing my idea of the present day conditions of amateur relay stations.

First of all I wish to say that I, myself, have sent many relay messages to different points, mostly east of Denver, to localities that have many large relay stations, but I am sorry to say that *not a one* out of at least twenty messages has ever reached its final destination. Why? Why should a station accept a message if he does not intend to or cannot, deliver it?

I will name the destinations of a few recent messages sent from here (Denver) so you may see just why I have a good base for my argument. First we have Chicago, Ill. When you ask a relay man if he can



QSR Chicago, why he will always say "Sure, that will be easy", yet I have never succeeded in getting a message delivered there, even after hearing the message given to a Chicago relay station. Then comes La Crosse, Wis. This is a large radio center, yet I have never succeeded in getting a message there. Then we have Aurora, Ill., about thirty or forty miles from Chicago; Rockford, Ill. approximately eighty-two miles from Chicago, and again we have no success in getting messages to any of these points. Again, I ask, what is the trouble? It isn't the radio relay league proper, it's the stations representing them improperly.

Mr. Editor, if you look at this subject as serious as I do, I am sure you will give it a little thought. I would appreciate it very much if you would consider publishing this problem in an early edition of the QST as I would like to hear some one else's opinion on this difficulty.

R. C. Schryver, 9AWL.

### CALLS HEARD

(Concluded from Page 60)

9AYS, 9AWM, 9QE, 9AOG, 9AFB, 9AZH, 9BJB, 9BOG, 9BVY, 9BRG, 9BRS, 9B3G, 9BLO, 9BAF, 9BFX, 9DHB, 9DDW, 9DSW, 9DJI, 9DYN, 9DVA, 9DZQ, 9DTH, 9ZG, 9ARK, 9ASF, 9DTS, 9DBG, Canadian 4CB, 3BP.  
Spark—Canadian 3JL, 3FO, 3EI, 3GN, 3BP.  
U.S.—4BQ, 3XM, 5SM, 5DD, 5XB, 5XU, 5FO, 5HK, 5XA, 8YU, 8JJ, 8CP, 8YN, 8BEP, 8BEF, 8ZP, 9APA, 9HI, 9HT, 9HR, 9KI, 9IY, 9OF,

9JQ, 9MS, 9MC, 9LW, 9OA, 9WT, 9WI, 9TI, 9ZX, 9XM, 9ZO, 9RC, 9AAP, 9AIF, 9AIG, 9AZA, 9AVZ, 9AYW, 9ANF, 9AMQ, 9AEG, 9AFK, 9AVP, 9DEH, 9DMC, 9DMK, 9DUG, 9DSD, 9DSM, 9DSO, 9DIW, 9BKW, 9DFA, 9DZY, 9DZI, 9DZE, 9YAJ, 9YAE, 9YAK, 9YAC.

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Thread Milling  
Japanning  
Plastic Material  
Pressing  
Electric Motor  
Manufacture

Punch Press Work  
Or

Complete Assembled  
Product of any Nature  
of a Medium Light  
Grade Interchangeable  
Type.

Wood Work from Box  
Shooks to Plain Type of  
Cabinet Work.

PLEASE REFER TO BOX "C,"  
QST, HARTFORD, CONN.

### WANTED: A Publicity Manager

*The A.R.R.L. desires to engage the services of a qualified publicity manager. In addition to knowing the ropes of his profession and being able to write, he must be a radio amateur of known attainments and fully acquainted with the A.R.R.L. spirit, its traditions and the amateur viewpoint. Give full qualifications in first letter, stating salary desired, etc., addressing the Secretary.*

American Radio Relay League,

Hartford, Conn.

## Of Interest to Display and Classified Advertisers

We are pleased to announce that this issue of QST is running 50,000 copies. The recognized merit of QST as the best magazine for the progressive radio amateur and experimenter—its nation-wide prestige as the publication of the American Radio Relay League, THE national association of amateurs, has resulted in an enormous yet healthy demand, and consequently greatly increased circulation. For the last number of months QST has grown by thousands with each issue, and this growth continues unabated. Of interest to the up-to-date advertiser is the fact that paid-in-advance circulation is growing in proper proportion to counter sales.

QST's unquestioned value to the progressive manufacturer and dealer is therefore immeasurably greater. The axiom that apparatus of merit can be most profitably advertised in QST is truer than ever.

Classified advertising is six cents a word in advance, as explained at the head of that department in this issue. Display advertising rates will be promptly mailed any reputable manufacturer or dealer. Please address:

Advertising Manager, QST, Kennedy Building, Hartford, Conn.

**Another**



**Achievement**

# The TELMACOPHONE

**Here Is the Height of Telmaco Perfection**

Equipped with Baldwin Type C Unit, Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail.

Don't be misled into buying a loud speaker offered for less, and expect satisfaction; for a loud speaker of quality cannot be sold for less. Only after the most exhaustive tests and comparisons with the other loud speakers; and only after the most thorough research, laboratory tests and field demonstrations has the **Telmaco-phone** been perfected, and offered now, for the first time to the public.

**Telmaco** Amplifiers, Receivers, Detectors, Variometers, and Variocouplers have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the Telmacophone.

We advise the purchase of the Telmacophone without unit for those who have Baldwin Unit of their own.

**Dealers!** We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

**RADIO DIVISION**

**Telephone Maintenance Co.**

NOTE NEW ADDRESS

20 S. Wells St.—Dept. D.

Chicago, Ill.



**No extras to buy.  
Nothing to get out  
of order.**

Price  
Complete \$20.00

Fully  
Guaranteed

Price without Baldwin Unit,  
but with cap attached, \$14.50

## WETMORE-SAVAGE COMPANY

BOSTON, MASS.

Jobbers of

**ELECTRICAL  
SUPPLIES**

**AUTOMOTIVE EQUIPMENT  
SUPPLIES**

Have Recently Entered the Field of

**RADIO APPARATUS AND SUPPLIES**

We will do a **WHOLESALE BUSINESS** only and solicit correspondence with reliable manufacturers who are desirous of receiving the best representation for the New England States.

# Reduce those QRN Atmospherics NOW with Burgess "B" Batteries

**N**OISELESS! That describes Burgess "B" Batteries. **Absolutely** noiseless! Weak and distant audio frequency signals can be received with multi-stage amplifiers and Burgess "B" Batteries because Burgess "B" Batteries do not drown out signals.

**B**URGESS "B" Batteries assure clear receiving. They will increase the efficiency of any receiving set. They are cheapest in hours of service. And they are sold by all reliable dealers in radio equipment. Look for the black and white stripes. If you can't get Burgess "B" from your dealer, just drop a line to us, care Dept. D.

## BURGESS BATTERY COMPANY

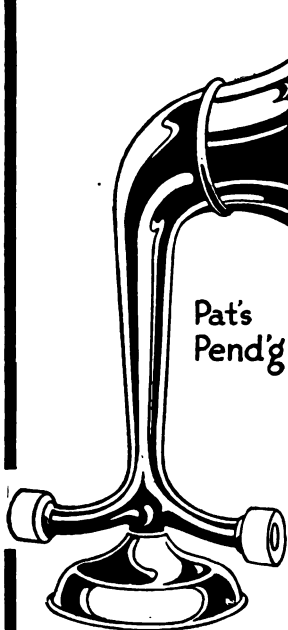
General Sales Office  
Harris Trust Bldg.,  
Chicago

Offices and  
Distributing Warehouses  
Chicago, Ill.,  
111 W. Monroe St.  
Madison, Wis.,  
Main & Beverly Sts.  
Kansas City, Mo.,  
2109 Grand Ave.  
St. Paul, Minn.,  
2362 University Av.  
Boston, Mass.  
136 Federal St.  
New York,  
50 Church St.  
Winnipeg, Man.,  
701 Wellington Av.

As indicated in the illustration, Burgess Batteries are supplied with both flexible wire terminals and binding post terminals. The binding post terminals are complete with hexagon nuts and brass nuts, making it possible to attach wires directly to the cells without the use of solder or bolts.



Price \$12.00 F.O.B. N.Y. City



NOTICE: All infringers of this device will be vigorously prosecuted.

# INTRODUCING THE KING "AM-PLI-TONE" A RADIO SURPRISE

*Listen to the Concerts, News and Dance with a KING "AM-PLI-TONE."*

Just slip your head phones on the "AM-PLI TONE" and you and your friends will be SURPRISED.

Polished Cast Aluminum Body with Nickle Plated Base and Horn. No sheet Metal is used, the "Tinny" Sound is Left Out. The VOLUME is DOUBLED because TWO head phones are blended into one POWERFUL tone.

A big hit—a big seller and immediate deliveries. Dealers and distributors what more can you ask? Write today for territory--KING "AM-PLI-TONE"

82 Church St., New York City

## IMMEDIATE DELIVERY

On DeForest Radiophone Sets at \$36.00  
and 2-Step Amplifiers at \$35.00

We are Jobbers for Grebe, DeForest, Clapp-Eastham, John Firth, Mignon, Hipco B. Batteries and Eveready Batteries.

WE CARRY VALLEY CHARGERS

**HICKSON ELECTRIC COMPANY, Inc.**

36 SOUTH AVE.,

ROCHESTER, N. Y.

# MURDOCK

## *radio necessities*

---



No. 56 Phones

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$5.00 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

*Buy Murdock apparatus from your dealer.*

---

# WM. J. MURDOCK Co.

# CW Transmitter and Receiver Parts



TYPE 156 SOCKET

The experimenter who has had previous experience with the assembly of receiving and transmitter sets has learned the necessity of having every unit perfect. Entirely aside from the gain in efficiency, he has found the advantage of using apparatus in which the greatest care has been given to construction details.

General Radio apparatus is designed with this end in view. A noteworthy example is the Type 156 Vacuum Tube Socket.

This socket is adapted to any of the standard American four-prong transmitting or receiving tubes. It is adapted to the Western Electric VT-2 tube, as well as to the Radiotron UV-200, 201 or 202 tubes. The contact springs are sufficiently rugged to carry the filament current of the five-watt transmitting tubes without arcing.

**Price \$1.50**

This is but one example. Others are Amplifying Transformers, Modulation Transformers, Tuning Inductances, Hot Wire Meters, etc. SEND FOR FREE BULLETIN 911Q describing these and other instruments.

## GENERAL RADIO COMPANY

Massachusetts Avenue and Windsor Street

CAMBRIDGE 39,

MASSACHUSETTS

*Standardize on General Radio Equipment Throughout*

CARRIED BY LEADING DEALERS

D. H. E. Co.—Pittsburgh Broadcasting Station—Call, K.Q.V.

## “Listen In” with the Stromberg - Carlson Headset



Stromberg-Carlson  
No. 2-A Headset

**\$7.50**

The Stromberg-Carlson No. 2-A Headset reproduces broadcasted, long-distance vocal or musical sounds with unequalled distinctness. Fine tonal qualities, extreme sensitiveness and superior construction are its important features.

Order Above and Following Highest Grade Supplies By Mail

Enclose Certified Check or P. O. Money Order including Postage.

R-C Westinghouse Receiver ..... \$130.00

Aeriola Senior Westinghouse Receiver ..... 65.00

CR9 Grebe Receiver ..... 130.00

CR5 Grebe Receiver ..... 80.00

RORK Grebe 2 Stage Amplifier ..... 55.00

R2 Magnavox Loud Speaker ..... 110.00

R3 Magnavox Loud Speaker ..... 45.00

UV200 Radiotron Detector Tubes ..... Each, 5.00

UV201 Radiotron Detector Tubes ..... Each, 6.50

#766 Eveready VT Batteries ..... Each, 3.00

D.H.E. 6 volt, 80 ampere storage batteries ..... Each, 18.00

Full List of Parts and Supplies with Prices on Request

## DOUBLEDAY-HILL ELECTRIC CO.

715 12th St., N. W., Washington, D. C., Radio Dept.—Desk A. 719-21 Liberty Ave., Pittsburgh, Pa.

### CODEGRAPH YOUR MESSAGES

Latest method of putting your messages in Cipher. Simple. Our booklet “Cipher Codes” and complete Instructions \$1.00. Send your Order Today.

CODEGRAPH COMPANY  
LOS ANGELES, CALIF.

P. O. BOX 848,

DEPT. MB-2.

### RADIO REALITIES

Our price list, mailed Free on request. Contains complete lists of reliable Radio Sets and parts—every article carrying our guarantee.

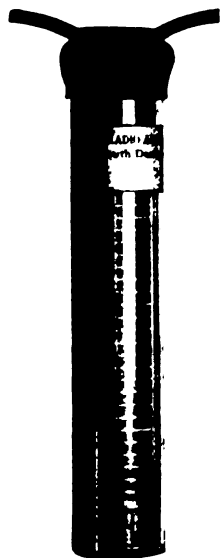
Write today—Special Terms for Dealers

THE KLEIN RADIO & ELECTRICAL  
SUPPLY CO.

48 FULTON ST.,

NEW YORK CITY

# "Chi-Rad" Apparatus



## New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

Simple and easy to re-charge from your lamp socket and will last for years with ordinary use.

Price per cell \$0.50  
Add PP on  $\frac{1}{4}$  lb.  
per cell.

### SPECIFICATIONS:

Cut shows cell one half natural size.

Voltage per cell 2 volts.

Pasted Plates—ready formed for initial charge.

High Ampere Hour capacity—will operate one detector tube 1000 hours with one charge.

Shipped dry with simple directions for preparing the electrolyte.

**Mahogany Tray for holding ten cells \$1.00 extra**

**Dealers:—Get our discounts on this new Battery—your customers will want them!**

### REMOVAL NOTICE

About April 1st we will move to 415 South Dearborn Street where we will open a High-Grade Ground Floor Salesroom. With greatly increased space we will carry every make of good Radio Apparatus and will endeavor to have

**"The Finest Radio Retail Salesroom in Chicago."**

**CHICAGO RADIO APPARATUS CO., Inc.**

**415 South Dearborn Street,**

**Chicago, Ill.**



## Hartford Radio Battery

Our radio "A" batteries are up to the Hartford Standard of excellence which means that no battery of any type leaves our plant until it has successfully surmounted a series of careful tests.

|         |                      |         |
|---------|----------------------|---------|
| Type 5R | 30 to 40 Ampere Hour | \$10.00 |
| Type 7R | 45 to 60 Ampere Hour | 12.00   |
| Type 9R | 60 to 80 Ampere Hour | 15.00   |

If there is not a Hartford dealer in your vicinity we will forward a battery direct to you upon receipt of draft or money order.

**The Hartford Battery Mfg. Co. Milldale, Conn.**

## SAFETY FIRST! — WIRELESS AMATEURS.

Protect your homes against damage from Lightning. Your insurance is void without proper ground protection

### OUR WIRELESS GROUND SWITCH 3333

Complies  
With  
Underwriters'  
Requirements.



Mounted on  
Ebony  
Asbestos  
Base, with  
5 inch brake  
600V SP DT.

Catalogue No. 3333 List \$3.50

**Barber Electric Manufacturing Company**  
North Attleboro, Mass.

If your dealer cannot supply you, your mail order will receive prompt attention.

**Best of Everything in  
Radio Apparatus and Parts**

Send Stamp for Catalog "Q"

**J. H. BUNNELL & CO.**

32 Park Place,

New York

**ASK**

Boston, Savannah, Philadelphia, New Orleans, Baltimore,  
San Francisco, Norfolk, Seattle, Portland.

**SHIP OWNERS**  
RADIO SERVICE INC.

80 WASHINGTON ST.  
NEW YORK

Send 6 cents in stamps for our latest booklet

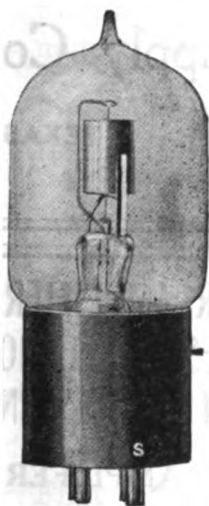
ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS.



# A-P

—the tubes which heard  
across the ATLANTIC  
—the tubes that are  
used by those who KNOW

## —this A-P COMBINATION

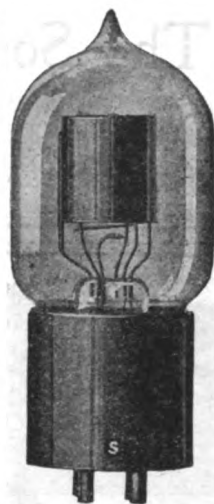


The A-P VT  
AMPLIFIER  
OSCILLATOR

—the Amplifier used by  
the U. S. Navy. "Use  
the tube the Navy  
uses." Price—\$6.50.

The A-P VT AMPLIFIER  
OSCILLATOR and the A-P  
ELECTRON RELAY, with  
the SHAW standard 4-prong  
base, are the perfect vacuum  
tube combination, the **original**  
vacuum tube combina-  
tion. Ask your dealer for  
these A-P tubes by name. If  
he does not have them, order  
direct—remittance must ac-  
company order.

*A-P tubes are licensed by the  
Radio Corporation of America  
under DeForest Audion and  
Fleming patents for amateur and  
experimental use in radio com-  
munication.*



The A-P  
ELECTRON  
RELAY

—the most sensitive de-  
tector of spark signals  
known to the radio art.  
Price—\$5.

## Atlantic-Pacific Radio Supplies Company

*Henry M. Shaw—President*

638 MISSION STREET — SAN FRANCISCO — CALIFORNIA  
EASTERN OFFICE — 5 KIRK PLACE — NEWARK — N. J.

National distributors for The Moorhead Laboratories, Incorporated.

**use A-P tubes for efficiency**

# ---it's in Dallas

Why send off for your Radio dope when "It's In Dallas." Standard lines at catalog prices with Service and Satisfaction is what you are looking for. Buy apparatus from us and let us give you Service and Satisfaction.

C'mon 5th. District, buy from the hub of the Southwest, the City that has made Radio famous in this neck of the woods, and from the Company that has had the major portion in developing Radio interest in Mr. Citizen. Our long experience enables us to handle your orders and inquiries with celerity—give us a trial!

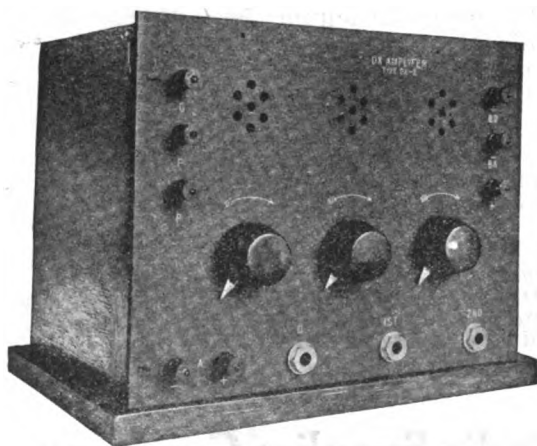
## The Southwest Radio Supply Co.

DALLAS,

217 St. Paul Street

Tel. X-3581

TEXAS



### A SUPER-AMPLIFIER for WIRELESS TELEPHONE and TELEGRAPH SIGNALS

#### DX AMPLIFIER

Type DX-2, Detector and Two step, with special amplifying transformers, completely wired, only,

**\$48.00**

#### IMMEDIATE DELIVERY

Satisfaction Absolutely Guaranteed  
Descriptive Folder sent upon request  
MFG. BY

### DX RADIO COMPANY, Not Inc.

Summit, Illinois,

"Where Dependable Quality Is Low Priced"

Factory, Argo

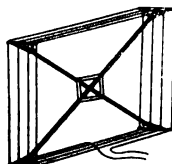
### One Hand Will Do Clip-Grip Screw Driver for Wireless



Holds the screw firmly while inserting or removing. Special wireless set of 2 sizes. Send 50c.

THE NOVA CO., Bonheur Bldg., 326 River St., Chicago

76



### RECEIVE ON AN INDOOR COIL AERIAL

Drawing, circuit diagram, chart and tables giving proper number of turns to put on coil for any wave lengths covering 0 to 3600 meters 50c; 3600 to 24000, 50c. Stamps not accepted. C. A. DAVIS & CO., 2371 Champlain N. W., Wash-  
D. C.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

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# PARAGON

THE

## Pioneer

- 1915 First regenerative receiver ever manufactured bore the name PARAGON.
- 1916 First Trans-continental Amateur Reception (California from New York; not pre-arranged) effected with a PARAGON Type RA-6 Receiver.
- 1916 First Trans-continental Amateur Transmission (New York to California; not pre-arranged) effected by PARAGON designed transmitter.
- 1917-1918 PARAGON acknowledged supreme on Western Front.
- 1921 First Trans-Atlantic Amateur Reception effected with PARAGON receiving equipment, at which time 27 different amateurs scattered thruout the Eastern section of the United States registered signals at Ardrossan, Scotland—3500 miles.

*THERE'S A REASON!*

## The Adams-Morgan Company

*Manufacturers*

UPPER MONTCLAIR, N. J.



# RHAMSTINE\* ADAPT-O-PHONE

There is a difference between the Rhamstine\* Adapt-O-Phone and the ordinary loud-speaking devices. It is a difference developed by the Rhamstine\* Shops following the exclusive Rhamstine\* Design.

Your own matched receivers are used, the sounds being clearly and correctly amplified in the Adapt-O-Phone; it is attractively finished and stands 20 inches high.

Send for complete circulars showing other Rhamstine\* Products—Plugs and Jacks, Amplifying Transformers, VT Sockets, VT Batteries, etc.

**\$12.00**

without receivers  
Add 25c for postage and packing.  
West of Rocky Mts. 40c.

Manufactured by

**J. THOS. RHAMSTINE\***

**2152 E. LARNED STREET.**

**DETROIT, MICH.**

\*Maker of Radio Products

## Try REYNOLDS RADIO Service from DENVER

(Old)  
"9ZAF"

(New)  
"KLZ"

|                                       |         |
|---------------------------------------|---------|
| Federal Jr. Receiving Set .....       | \$25.00 |
| #14 Stranded Aerial Wire 100 ft. .... | \$1.00  |
| #14 Stranded Aerial Wire 150 ft. .... | 1.50    |
| #14 Solid Aerial Wire 100 ft. ....    | .75     |
| #14 Solid Aerial Wire 150 ft. ....    | 1.10    |
| Hopewell Insulators All Sizes .....   |         |

### BOOKS

|   |         |
|---|---------|
| "Experimental Wireless Stations," Edelman .....       | \$3.00  |
| "Wireless Telegraphy & Telephony," A. P. Morgan ..... | 1.50    |
| "Radio Hookups," M. B. Sleeper .....                  | .75     |
| "Design Data," M. B. Sleeper .....                    | .75     |
| "Design of Modern Radio Sets," M. B. Sleeper .....    | .75     |
| Acme 200 Watt C.W. Transformers .....                 | \$20.00 |
| Clapp-Eastham Filament Transformers .....             | 12.50   |

| MAGNET WIRE |      |      |      |
|-------------|------|------|------|
| Spool       | Size | SCC  | SSC  |
| 4 oz.       | 20   | .45  | .50  |
| 4 oz.       | 22   | .50  | .55  |
| 4 oz.       | 24   | .50  | .55  |
| 4 oz.       | 26   | .55  | .70  |
| 8 oz.       | 20   | .65  | .80  |
| 8 oz.       | 22   | .75  | .90  |
| 8 oz.       | 24   | .80  | 1.00 |
| 8 oz.       | 26   | .85  | 1.15 |
| 12 oz.      | 20   | .90  | 1.10 |
| 12 oz.      | 22   | 1.00 | 1.35 |
| 12 oz.      | 24   | 1.10 | 1.40 |
| 12 oz.      | 26   | 1.25 | 1.65 |

Complete line Jewell Meters.  
Include postage with all orders.

**REYNOLDS RADIO CO. Inc.** Distributors **DENVER, Colo.** 613 19th Street

### G-A STANDARDIZED RADIO SUPPLIES

FOR THE MAN WHO MAKES HIS OWN  
Send 10c for the new G.-A. catalog

**The General Apparatus Co., Inc.**

88-T PARK PLACE

NEW YORK

### WIRELESS TELEPHONE AND RADIO APPARATUS (Complete Sets)

**CLARK & MILLS ELECTRIC COMPANY**  
ELECTRAGISTS

75 Newbury St., BOSTON

Tels. Back Bay 365 & 366 & 5286

1444 Massachusetts Ave., CAMBRIDGE

Tel. University 1100

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

"The right path is near,  
"yet men seek it afar off,"  
says Mencius.  
The right Receiver is here--  
the Grebe CR-5--  
The Wise Radioist  
need seek no further!

*Doctor Wu*

HAUGEN

GREBE RADIO

Licensed under  
Armstrong U. S. Patent,  
No. 1113149.

## Chelsea No. 50 Amplifying Transformer



Was designed for use with the present day models of vacuum tubes, and when so used produces remarkable amplification, with minimum noise. It is well adapted for table mounting or may be panel mounted in any position. Its high efficiency together with its neat appearance and compactness, makes it a predominating feature in any radio receiving equipment.

Price as shown .....\$4.50  
Unmounted .....3.75

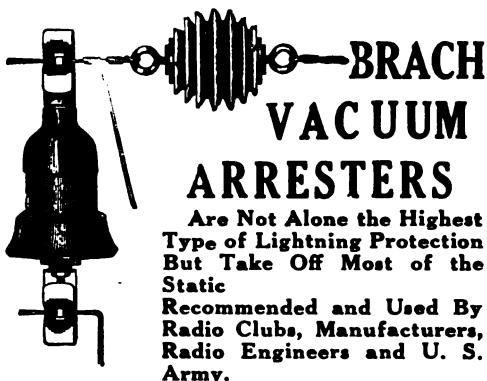
*Bulletins sent upon request*

Purchase from your dealer. If he does not have it, send to us.

**CHELSEA RADIO COMPANY**

160 FIFTH STREET,

CHELSEA, MASS.

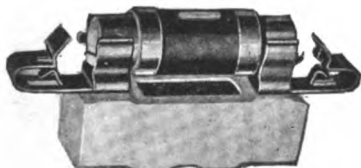


### BRACH VACUUM ARRESTERS

Are Not Alone the Highest Type of Lightning Protection But Take Off Most of the Static Recommended and Used By Radio Clubs, Manufacturers, Radio Engineers and U. S. Army.

Approved, Listed and Recommended by the National Board of Fire Underwriters.

**GIVE AUTOMATIC PROTECTION**



Carried in Stock by All Dealers and Distributed by Leading Electrical and Radio Jobbers.

**L. S. BRACH MFG. CO.**

Manufacturers of Lightning Arresters for 16 Years  
NEWARK, N. J.

## ANNOUNCEMENT

On and after May 1st. 1922

THE

**Radio Electric Co.**

will be located at its

**New Five Story Building**

1427-29 LIBERTY AVENUE  
PITTSBURGH, PA.

Manufacturing and Wholesale Business will be carried on Exclusively at this location, attended by the same Expert Radio Service you have enjoyed in the past.

**ALL RETAIL SALES**

will be handled at

**The Radio Electric Co.**

3807 Fifth Ave., Pittsburgh, Pa.

#### **SALES OFFICES**

50 Church St.,  
New York, N. Y.  
9 South Clinton Street,  
Chicago, Ill.  
414 Finance Building,  
Cleveland, Ohio  
1042 Granite Building,  
Rochester, N. Y.  
422 First Avenue,  
Pittsburgh, Pa.



#### **SALES OFFICES**

Sheldon Building,  
San Francisco, Cal.  
932 Real Estate Trust Bldg.,  
Philadelphia, Pa.  
321 Title Building,  
Baltimore, Md.  
415 Ohio Building,  
Toledo, Ohio

## **For the Capable Radio Technician**

**T**HE man who really knows radio—who can build his own instruments and keep them in condition—is always a friend of Formica insulation.

He knows what insulation troubles mean, and he knows that cheap absorbent materials full of weak spots are sure to worry him sooner or later.

Formica is approved by the Navy and the Signal Corps. It is weather-proof, warp-proof and maintains its good looks and high dielectric strength under all conditions. It is a solid insulating material of the highest efficiency all the way thru.

Formica works easily with ordinary tools and does not chip or crack. You can get panels cut to size from most radio dealers and the only tool needed to complete the panel is a drill.

Write now for descriptive folder on Formica

**The Formica Insulation Company**  
4620 Spring Grove Avenue,  
Cincinnati, O.,

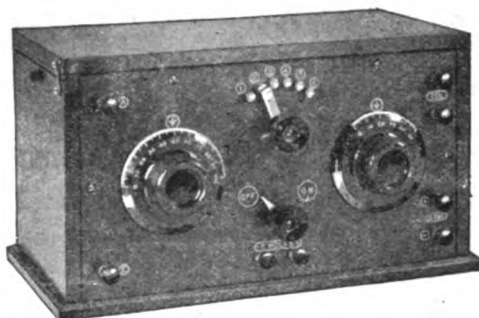
# **FORMICA**

**Made from Anhydrous Redmanol Resins**

**SHEETS      TUBES      RODS**

# TUSKA

**Type  
224**

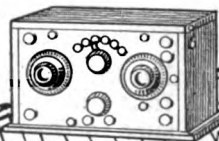


**Price  
\$35.00**

**Tuska Regenerative Tuner—ready for Tube, Phones, and Battery. The ideal outfit for expert or beginner. Two knobs: one for wave length; the other for amplifying. Type 224 has stood the test of public trial.**

Send 5c. for New Tuska Catalog No. 3.

**THE C. D. TUSKA CO.**  
38 HOADLEY PLACE, HARTFORD, CONN.



## For REAL Service

**Mail your orders to us. We can supply you with the BEST at the BEST PRICES. Shipments made within 24 hours after receipt of order.**

**CATALOGUE  
\$22  
AT YOUR  
SERVICE**

**THE SERVICE RADIO EQUIPMENT CO.**

Designers—Manufacturers—Distributors

225 SUPERIOR ST.,

TOLEDO, OHIO



## Radio Frequency Transformers

Type RT-1, for the amateur and broad-casting range, 175-500 meters.  
(Patent Pending)

**\$6.00**

*Will work on all tubes.*  
The only completely shielded iron-core  
R. F. Transformer



**RASLA SALES CORPORATION**

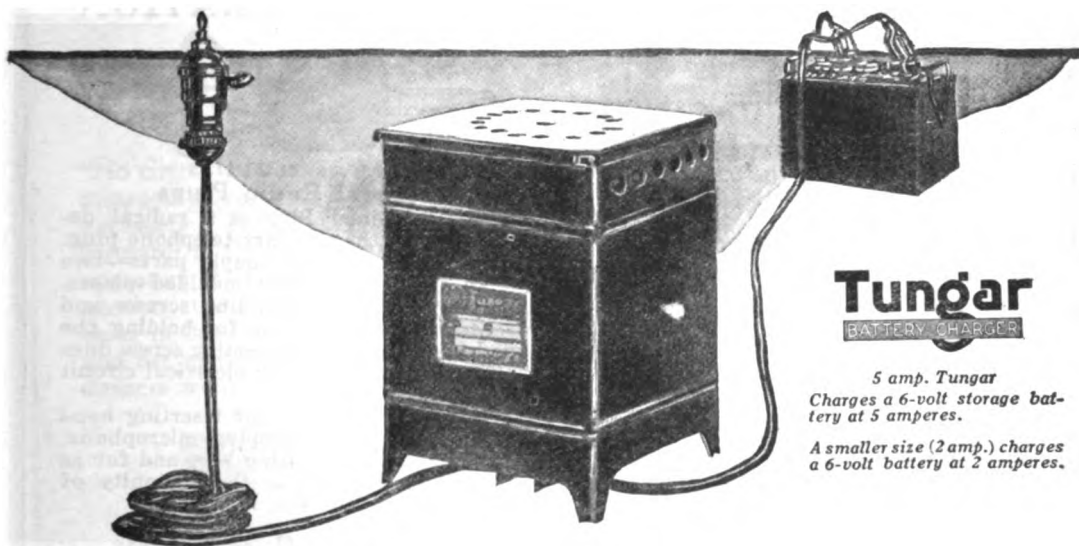
National Distributors for Radio Service Laboratories, Inc.  
10 EAST 43d ST.,

NEW YORK CITY

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



*"There's No Place Like Home"  
To Charge Your Radio Battery*



**Tungar**  
BATTERY CHARGER

*5 amp. Tungar  
Charges a 6-volt storage bat-  
tery at 5 amperes.*

*A smaller size (2 amp.) charges  
a 6-volt battery at 2 amperes.*

If you use tubes in your radio receiver you use a storage battery.

If you use a storage battery it must be charged.

**Charge Your Storage Battery at Home  
with a Tungar Battery Charger**

Without taking the battery out of the house—in fact, without moving it at all—you can charge it easily and quickly at a minimum of expense, trouble and lost time.

Isn't this much better than taking the battery to a charging station, leaving it a day or two, paying from 75¢ to a couple of dollars and then carrying it back again?

The Tungar is a small, compact rectifier which connects to any a. c. lighting circuit wherever there is a socket or receptacle and requires no attention while operating. Its first cost is not high and it can be operated by anyone without the slightest danger of injuring the battery. Send for new radio booklet and prices.

**General Electric**  
General Office Schenectady, N.Y. **Company** Sales Offices in all large cities 35-A70

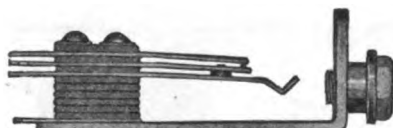
ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

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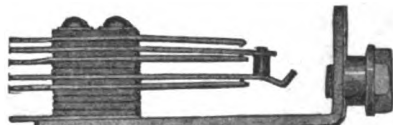
# FEDERAL

## RADIO APPARATUS

**WILL SIMPLIFY  
YOUR OPERATION**



No. 1435-W PRICE (In U.S.A.) \$1.00



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### Federal Filament Control Jacks

Eliminate innumerable switches and complicated control on your Detector and Amplifying units.

Simplify operation; save current; make your set up-to-date and efficient.



No. 15. PLUG \$1.75

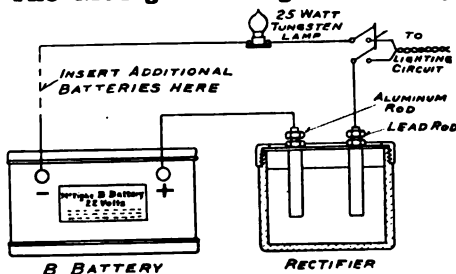
### Federal Radio Plugs

No. 15 Universal Plug is a radical departure from the ordinary telephone plug. Consists of only five simple parts—two highly finished Bakelite moulded pieces, the plug with its connecting screws and a brass screw and collar for holding the two together. This connecting screw does not come in contact with electrical circuit in any way.

The plug may be used for inserting head telephones, power supply, microphone, transmitters, transmitting keys and for as many other purposes as the ingenuity of the radio operator may dictate.

**Federal Telephone & Telegraph Company**  
**Buffalo, New York**

### The McTighe Storage B Battery



The McTighe Storage "B" Battery is of the alkaline type, is the most satisfactory source of plate potential, and can be charged from your lighting circuit for less than one cent. Can also be charged from farm lighting systems. In ordinary service a one hour charge will last for several weeks.

The Battery is furnished in a 24 volt unit in an attractive case.

It is noiseless, and cannot be injured by accidental short circuit, overcharging or by standing idle.

Descriptive Leaflet on request

#### PRICES

|                     |        |
|---------------------|--------|
| Battery .....       | \$4.00 |
| Rectifier .....     | 1.50   |
| Rubber Filler ..... | .25    |

F. O. B. Irwin, Pa.

### ECONOMIC APPLIANCE COMPANY

Successor to  
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Irwin, Pa.

## PANELS

Cut to order

|                               |         |
|-------------------------------|---------|
| 1/8 thick per square inch ..  | .01 1/2 |
| 3/16 thick per square inch .. | .02     |
| 1/4 thick per square inch ..  | .02 1/2 |

## MAGNET WIRE

1/2 lb Spools

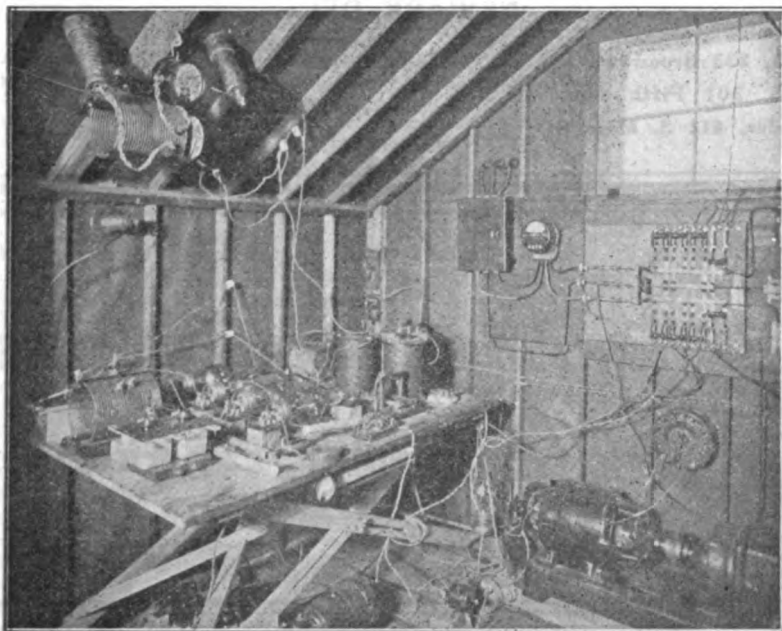
|    | Enam | S.C.C. | D.C.C. |
|----|------|--------|--------|
| 20 | .52  | .50    | .60    |
| 22 | .54  | .65    | .75    |
| 24 | .56  | .75    | .85    |
| 26 | .58  | .80    | .95    |
| 28 | .62  | .95    | 1.20   |
| 30 | .66  | 1.02   | 1.40   |

**Pittsburgh Radio &  
Appliance Co., Inc.**

112 Diamond St., Pittsburgh, Pa.

# Dubilier Condensers Helped to Make Radio History

**"No circuit is stronger than its weakest link."** When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



**Are your condensers the weakest link in your circuit?** There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

**The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.**

## **Pacent Electric Company, Inc.**

**150 Nassau Street,**

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**Member Radio Section Associated Manufacturers of Electrical Supplies.**

# RADIO PANELS

and  
other insulation for Wireless Work

## BAKELITE - DILECTO

Grade XX Black was used by the Government during the war for this purpose. It is the

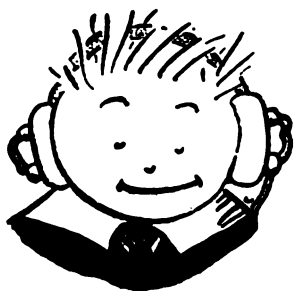
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The present tremendous demand for Radio Apparatus has practically made it impossible for us to render our usual SERVICE. Reasonably prompt delivery however can be made on the items listed.

## AMPLIFYING TRANSFORMERS

|   |        |
|---|--------|
| No. P-1 General Radio, semi-mounted ..... | \$5.00 |
| No. 50 Chelsea, semi-mounted .....        | 4.50   |
| No. A-2 Acme, semi-mounted .....          | 5.00   |

## ANTENNA WIRE

|  |      |
|--|------|
| "Pittsco" #14 hard drawn copper, (80 ft. per lb.) per lb. .... | .40  |
| 500 ft. (Special value) .....                                  | 2.25 |
| "Pittsco" 7 strand #22 tinned copper, per ft. ....             | 0.01 |
| 500 ft. ....   | 4.00 |
| 1000 ft. ....  | 7.50 |
| "Pittsco" 7 strand #20 Phosphor bronze per ft. ....            | 0.02 |
| 500 ft. ....   | 7.50 |

## ANTENNA INSULATORS

|  |     |
|--|-----|
| No. P-1 Electrode Ball insulator .....           | .35 |
| No. P-2 Electrode 4 inch strain insulator .....  | .45 |
| No. P-3 Electrode 10 inch strain insulator ..... | .75 |

## "A" BATTERIES (Storage Batteries)

|                                   |       |
|-----------------------------------|-------|
| Yale 6 volt 60 Ampere-hours ..... | 18.00 |
| Yale 6 volt 80 Ampere-hour .....  | 21.00 |
| Yale 6 volt 100 Ampere-hour ..... | 25.00 |

Note—These batteries are shipped carefully crated and fully charged ready for use.

## "A" BATTERY RECTIFIERS

|  |       |
|--|-------|
| No. P-1 Tungsar, 5 ampere type, complete with bulb ..... | 23.00 |
| No. P-2 Tungsar, 2 ampere type, complete with bulb ..... | 18.00 |
| No. P-3 F. F. Battery Booster, 5 ampere type .....       | 15.00 |

## "B" BATTERIES

|  |      |
|--|------|
| No. 763 Eveready, 22.5 Volt, small size .....                  | 1.75 |
| No. 766 Eveready, 22.5 Volt, large size 16½ to 22½ Volts ..... | 3.00 |
| No. 774 Eveready, 43 Volt, large size Variable .....           | 5.00 |

## CRYSTAL RECEIVING SETS

|   |       |
|---|-------|
| Aeriola Jr., Westinghouse, complete with telephones ..... | 25.00 |
| Everyman DeForest, complete with telephones .....         | 25.00 |

## CONDENSERS (Variable)

|   |      |
|---|------|
| No. 1 Chelsea fully mounted, .001 Mf. ....                      | 5.00 |
| No. 2 Chelsea fully mounted, .0005 Mf. ....                     | 4.50 |
| No. 3 Chelsea unmounted with dial .001 Mf. ....                 | 4.75 |
| No. 4 Chelsea unmounted with dial .0005 Mf. ....                | 4.25 |
| No. 367 Murdock fully mounted .001 Mf. ....                     | 4.50 |
| No. 368 Murdock fully mounted .0005 Mf. ....                    | 4.00 |
| No. 3660 Murdock unmounted without knob and dial .001 Mf. ....  | 4.00 |
| No. 3680 Murdock unmounted without knob and dial .0005 Mf. .... | 3.25 |

## TELEPHONES

|  |      |
|--|------|
| No. 56 Murdock 2000 ohms .....           | 5.00 |
| No. 56 Murdock 3000 ohms .....           | 6.00 |
| No. 2A Stromberg Carlson 2000 ohms ..... | 7.50 |
| No. P-1 Holtzer-Cabot 2200 ohms .....    | 8.00 |

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Our SERVICE on these at the present time will please you!

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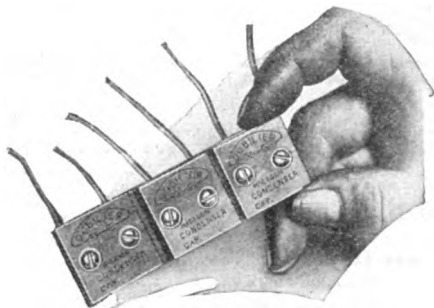
3 Stores

276 Worthington St.  
Springfield, Mass.

# DUBILIER MICADONS For

*Two remarkable mica condensers*

Use Micadons Type 601  
Like Building Blocks



Dubilier Micadon Type 601 is here shown one-third full size. It has the same perfect mica insulation, the same *perma-ent* capacity that has always characterized the famous, larger standard Dubilier mica condenser.

Dubilier Micadon Type 601 is only a little larger than a postage stamp. Micadons Type 601 can be used to build up capacity as if they were building blocks. Simply add one to the other with a few machine-screws, and you pile up any desired capacity. Connect them in series or multiple.

Buy Micadons Type 601 by the dozen, and keep them on hand.

The capacity ranges from .005 to .0001 mfd. Price 35 cents each. By the dozen \$4.00.

Make Your Own Grid-Leak  
with a Lead Pencil



Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub point of an ordinary black lead pencil over the roughened surface as here shown. To adjust the grid-leak

thus made rub away as much of the graphite that has been deposited as may be necessary.

Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.

## Why Tubes Howl

Faulty condenser construction interfere with the reception of broad. The alternate layers of insulating contract with the oscillations of cur often as a million times a second. The tube responds with howling.

## Micadons Have

Dubilier patented Micadons have experimenting to overcome this dif made like the famous, larger Dubi standard equipment by ninety-five radio companies of the world.

This means that in the Dubilier conducting layers have been pressed mass. The air has all been squeezed and contraction of the layers. The Tube noises, due to poor condenser

Dubilier Micadons last indefinitely. densers do.

## Amazingly

Dubilier Micadons are amazingly est receiving condensers ever pre mand for inexpensive mica con with the cheapest or the most costly

Two types of Dubilier Micadons They are pictured and described on Specify Dubilier condensers and Micadon is a trademark, adopted for these remarkable little mica con

Examine your set and see if it has are not receiving broadcasted news

Order Dubilier from your dealer or lier Condenser Co., 217 Center Street,

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Canadian General Electric Co.,  
Toronto

LICENSEES FOR ENGLAND

Dubilier Condenser Co., Ltd., London

# DUBILIER CONDENSER

# Perfect Broadcasting Reception

for 35 cents to \$1.00 each

## and Whistle

causes many of the noises that incasted music and entertainment. and conducting material dilate and rent in the antenna—sometimes as The capacity varies correspondingly. whistling and sputtering.

## Permanent Capacity

been developed after long and costly ficulty. They are mica condensers. ller mica condensers adopted as per cent of the governments and

Micadons both the insulating and together so as to constitute a single out. Hence there can be no dilation capacity is *absolutely permanent*. construction, are impossible. They will not burn out, as paper con-

## Low in Price

low in price. Also they are the small-duced. They meet the popular den- sencers which can be used either receiving set.

are made—Type 600 and Type 601. these pages.

follow the government's example. your protection and applied only to densers.

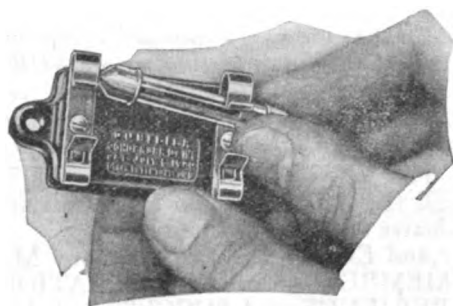
Dubillier Micadons. If it has not you and music perfectly.

from the manufacturers, the Dubi- New York.

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AND SOUTH AMERICA

Telefunken Company,  
Berlin

## For the Price of a Single Grid-Leak Holder



Here we show Dubillier Micadon Type 600 one-half full size. It is a perfect Dubillier mica condenser, especially made to improve broadcasting reception. It costs no more than an ordinary grid-leak holder.

Dubillier Micadon Type 600 lasts indefinitely. Its capacity is *permanent*. There can be no variations and no leakage.

Dubillier Micadon Type 600 is provided with Fahnestock connectors and grid-leak clamps. The grid-leak can be easily removed and replaced with the fingers.

Everything is soldered. The container is of molded composition. Provision is made for holding screws.

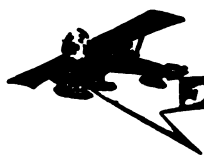
## Use a Crystal Detector Instead of the Grid-Leak

It is easy to substitute a crystal detector for the grid-leak if desired. Thus it becomes possible to use Dubillier Micadon Type 600 with crystal detector sets and obtain all the benefits that follow when a perfectly constructed mica condenser is used.

Price of Dubillier Micadon Type 600 in capacities ranging from .001 to .005 mfd. 75 cents each.

Price of Dubillier Micadon Type 600 in capacities ranging from .005 to .01 mfd. \$1.00 each.

# COMPANY, 217 Center St., New York



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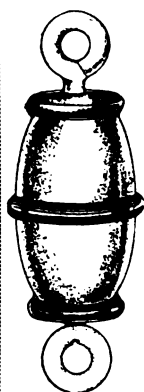
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F. D. PITTS, Director.

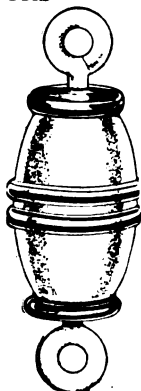
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| No. CR-5 Grebe super-special 175-3000 meters with detector complete .....                                      | 80.00   |
| No. CR-8 Grebe 175-1000 meters with detector latest type short wave set .....                                  | 80.00   |
| No. CR-9 Grebe 175-3000 meters complete with det. & 2 stage amplifier .....                                    | 130.00  |
| No. CR-6 Grebe 175-680 meters with det. and 2 stage amp. phone & series cond. ....                             | 200.00  |
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| No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact ..... | 130.00  |

## KENNEDY EQUIPMENT

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|------------------------------|----------|
| Type 110 Universal .....     | \$250.00 |
| Type 2001 Intermediate ..... | 125.00   |
| Type 281 Short Wave .....    | 80.00    |
| Type 525 Amplifier .....     | 85.00    |
| Type 521 Amplifier .....     | 55.00    |

## RECEIVING SETS (Crystal)

|   |         |
|---|---------|
| "Aerola Jr.," Westinghouse, complete with Brandes "Superior" phones ..... | \$25.00 |
| "Radiola" DeForest, complete with Brandes "Superior" phones .....         | 25.00   |

## VACUUM TUBES

|                                      |        |
|--------------------------------------|--------|
| No. UV-200 Radiotron detector .....  | \$6.00 |
| No. UV-201 Radiotron amplifier ..... | 6.50   |
| No. UV-202 Radiotron 5 watt .....    | 8.80   |
| No. UV-203 Radiotron 50 watt .....   | 30.00  |
| No. UV-204 Radiotron 250 watt .....  | 110.00 |

## "B" BATTERIES

|   |        |
|---|--------|
| No. 763 Eveready 22½ volts .....        | \$2.25 |
| No. 766 Eveready 22½ volts tapped ..... | 3.00   |
| No. 5156 Burgess 22½ volts tapped ..... | 3.00   |
| No. 2156 Burgess 22½ extra large .....  | 3.50   |

## TELEPHONES

|   |        |
|---|--------|
| No. 56 Murdock 2000 ohm .....               | \$5.00 |
| No. 56 Murdock 3000 ohm .....               | 6.00   |
| No. C Baldwins .....                        | 12.00  |
| No. E Baldwins .....                        | 13.00  |
| No. F Baldwins .....                        | 14.00  |
| No. G Baldwins new style static-proof ..... | 15.00  |
| No. C Baldwins single unit only .....       | 6.00   |
| No. Brandes "Superior" type .....           | 8.50   |
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PROMPT DELIVERIES**

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| B. Batteries Radisco large-tapped 22½ V. ....  | 2.65   |
| B. Batteries Eveready large-tapped 22½ V. .... | 3.00   |
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| Tubes UV201 Radiotron Amplifier .....          | 6.50   |
| Tubes UV202 Radiotron Trans-5 watt .....       | 8.00   |
| Tubes UV203 Radiotron Trans. 50 watt .....     | 30.00  |
| Tubes C300 Cunningham Detector .....           | 5.00   |
| Tubes C301 Cunningham Amplifier .....          | 6.50   |
| Tubes Electron Relay Detector .....            | 5.00   |
| Tubes A & P Amplifier .....                    | 6.50   |
| Phones Murdock 2000-ohm .....                  | 4.50   |
| Phones Murdock 3000-ohm .....                  | 5.50   |
| Phones Brandes Superior .....                  | 8.00   |
| Phones Brandes Navy .....                      | 14.00  |
| Phones Baldwin Type C .....                    | 12.00  |
| Phones Baldwin Type E .....                    | 13.00  |
| Phones Baldwin Type F .....                    | 14.00  |

## QUALITY

|                                    |        |
|------------------------------------|--------|
| Sockets Paragon .....              | \$1.00 |
| Sockets Murdock .....              | 1.00   |
| Sockets G. A. ....                 | 1.50   |
| Sockets DeForest .....             | 1.20   |
| Rheostats Paragon .....            | 1.50   |
| Rheostats DeForest .....           | 1.65   |
| Rheostats Gen. Radio .....         | 2.50   |
| Rheostats Remler-Jr. ....          | 1.00   |
| Remler Rheostat .....              | 1.50   |
| Rheostats Parkin .....             | .75    |
| Corwin Dial & Knob 3" .....        | 1.00   |
| Corwin Dial & Knob 3½" .....       | 1.20   |
| Dial and Knob Chelsea .....        | 1.00   |
| Transformers, Acme Unmounted ..... | 4.50   |
| Transformers, Acme Sem-mtd. ....   | 5.00   |
| Transformers, Acme Mounted .....   | 7.00   |
| Transformers, Federal .....        | 7.00   |
| Transformers, UV712 .....          | 7.00   |

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

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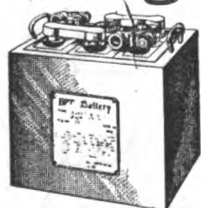
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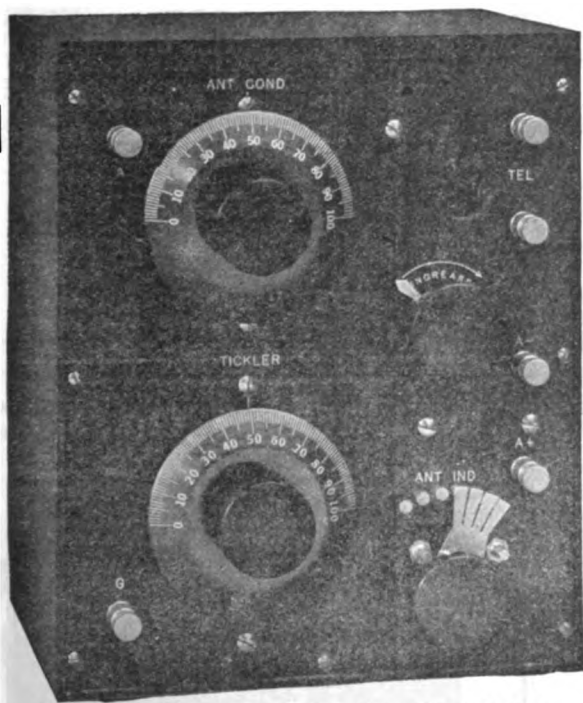
## Bridgeport Storage Battery Co.

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**DIALS**—Indestructible metal. White figures on black ground.  
**ANTENNA INDUCTANCE**—Wound on Formica Tube  
**PLATE INDUCTANCE**—Wound on molded ball.  
**BINDING POSTS**—Black Rubber Covered.  
**SWITCH**—Fan Blade.  
**RHEOSTAT**—C. E. Type H 400.  
**CIRCUIT**—Single circuit regenerative. Licensed under Armstrong U. S. Patent No. 1113149.  
**"B" BATTERY**—Contained in compartment inside cabinet or external as desired.

**Q**UALITY—and at a reasonable price—is the appeal that the Clapp-Eastham Type H. R. Regenerative Receiver makes to men who know wireless equipment. The specifications and the Clapp-Eastham reputation tell them the story. To the novice, the appearance of the set, the clear, sharp tones, its wide range, and the perfect regeneration on all wave-lengths between 180 and 825 meters, is convincing evidence. The quality in the solid mahogany Cabinet is reflected all throughout the set. Ask your dealer to show it to you. If he's temporarily out—and he may be, because the demand has been phenomenal—write us. Send 6c. in stamps for the C-E Radio Catalog. If you're at all interested in wireless you ought to have it.

## **CLAPP-EASTHAM COMPANY**

**Radio Engineers and Manufacturers Since 1905**

**114 Main Street,**

**Cambridge, Mass.**



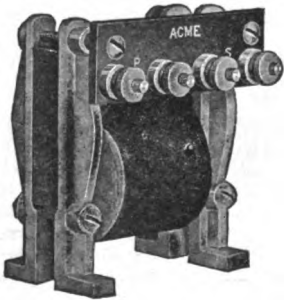
## ANNOUNCEMENT

### THE SALES DIVISION OF THE PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY

will hereafter be conducted under the name of  
**PHILADELPHIA WIRELESS SALES CORP.**  
1533 Pine Street, Philadelphia

The new corporation is owned and controlled by the same parties as heretofore and the business will be carried on without change of personnel. This change of name was deemed advisable in that our trade name did not indicate the full scope of our business.

The name of the school will be used only for purely school matters.



### *Amplify your signals with ACME Transformers*

Acme Transformers in your vacuum tube amplifier equipment, magnify voice and music as well as code without distortion and without howling. They are priced as low as specialized quantity production permits, with due regard for quality. At all Radio dealers.

**Acme Apparatus Co.**

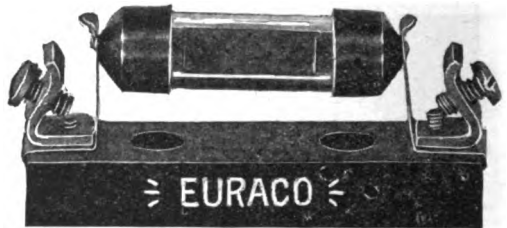
194 Massachusetts Ave.,  
Cambridge, Mass.

Transformer and Radio Engineers and  
Manufacturers

### "Euraco" Mica Condenser

PRICE 60 CENTS

Designed to Fit Standard Grid Leak Base



Composed of Copper and Mica, Entirely Hand Made.

Compact, Interchangeable, Most Efficient

Following Capacities in Stock:

- .00025 Mfd.—Correct for Super Heterodyne and UV-201.
- .0001 Mfd.—For special and experimental circuits.
- .000025 Mfd.—Correct for Radio-Audion RAC-3 valve.
- .0005 Mfd.—Correct for Radiotron UV-200

Condenser Mountings:

- Bakelite Base with Single Mounting..\$0.40
- Bakelite Base with Double Mounting.. .60
- Bakelite Base with Triple Mounting.. .80

Interesting Proposition for Dealers

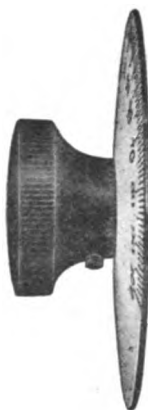
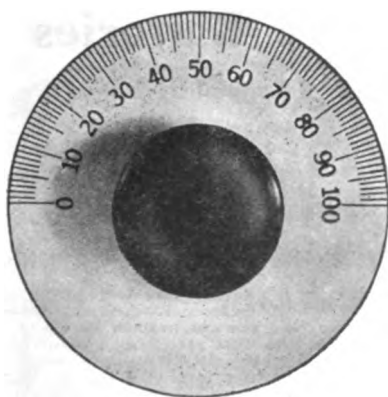
**EUROPEAN RADIO CO.**

Mfrs. of Multi-Stage Amplifiers, C.W. & Special  
Equipment

1342 East 22 St.,

Brooklyn, N. Y.

**EXCLUSIVE**



**FEATURE**

## J-RAY WHITE ENAMELED DIAL VITREOUS WHITE PORCELAIN-ENAMEL ON COPPER

We herewith present our beautiful new white enameled metal dial, with heavy black engravd scale, fused into the enamel under heat treatment.

The smooth white watch-face enamel finish of this dial is unexcelled by any now offered. Besides its beautiful appearance against the conventional black Receiving Panels, our dial, due to its metallic construction, acts as a shield against body capacities. This feature alone is a most important reason why you should use the J-Ray Dial as those who are familiar with the annoying body-capacity effects will testify. Dial will not crack, warp, rust, change color, tarnish or grow dim with age. Lasts and maintains its new appearance forever.

Center of dial is raised or domed as per the conventional type.

Knurled Black Composition Knob completes the dial's beauty and finish.

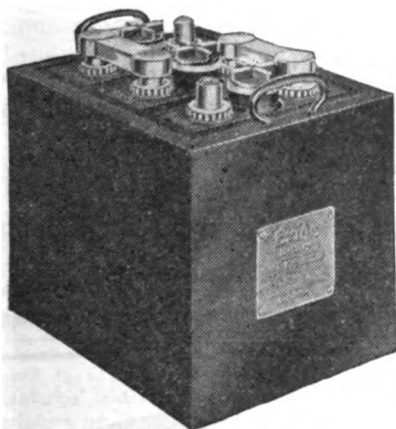
Diameter of Dial 3 in. Diameter of Knob  $1\frac{1}{4}$  in. Center Bushing for  $\frac{1}{8}$  or  $\frac{1}{4}$  in. shaftings.

Price, complete with knob \$1.00. Without knob \$0.80.

Send for Bulletin 3 describing the above Dial and our Receiving Apparatus.

Dealers—We can make prompt shipments on Dials in any quantity. Write for attractive proposition

## THE NEW EXIDE RADIO BATTERY IS NOW READY!



When the evening meal in countless homes is finished, the family settles itself comfortably in the living room for an evening's entertainment by wireless telephony.

The instrument is set up, a dial is turned, and from a distant city the voice of an operatic star fills the room. Or, at another turn of the dial, bed-time stories for the children are heard. Again, the strains of a church organ, the voices of the choir as well as the sermon, are heard from some church many miles away.

But to insure maximum enjoyment from any radio outfit, an absolutely dependable storage battery is essential—a battery designed to provide steady current—a battery whose voltage will not drop after a few minutes' use and necessitate frequent adjustments of the apparatus.

To meet these demands the Exide Radio Battery has been built.

From its practically unbreakable jars to its bolt connector terminals, every detail of this battery reflects the intimate knowledge of storage batteries which its builders possess.

The splendid results obtained with the Exide Radio Battery can be definitely attributed to the long experience behind it. For in the thirty-four years that Exide Batteries have been built for every purpose, much has been learned that was applied in designing a battery specifically for radio work.

Plates that insure long life without reducing their activity; wood separators of the type that have proved

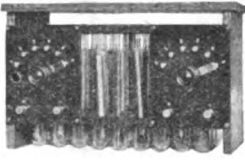
so successful in the famous Exide automobile batteries; jars that will withstand an unusual amount of hard usage; and terminals that insure perfect contact through the simple tightening of a nut—these are briefly, some of the features of the Exide Radio Battery.

The following table shows the four sizes in which this battery is made, with ampere-hour capacities ranging from 20 to 120, according to the number of plates. The over-all height of the battery is approximately 9  $\frac{1}{4}$  inches; the width, 7  $\frac{1}{4}$ ; while the length, varying with the number of plates used, is given in the following table:

| Type     | Cat. No. | Length           | Weight                | Capacity      | Price F.O.B. St. Louis, Mo. |
|----------|----------|------------------|-----------------------|---------------|-----------------------------|
| 3-LXL-3  | 13735    | 4 $\frac{1}{4}$  | 15 $\frac{1}{2}$ lbs. | 20 amp. hrs.  | \$13.75                     |
| 3-LXL-5  | 13736    | 5 $\frac{1}{4}$  | 24 $\frac{1}{2}$ lbs. | 40 amp. hrs.  | 17.85                       |
| 3-LXL-9  | 13737    | 9 $\frac{1}{4}$  | 42 $\frac{1}{2}$ lbs. | 80 amp. hrs.  | 23.46                       |
| 3-LXL-13 | 13750    | 12 $\frac{1}{4}$ | 59 $\frac{1}{2}$ lbs. | 120 amp. hrs. | 30.60                       |

Distributed By

**J-RAY MFG. CO., 1618 Chestnut St., St. Louis, Mo.**



# Storage Batteries

Designed Especially For

# WIRELESS

*"Cheapest in the long run"*



## KICO "B" BATTERY

## KICO "A" BATTERY

The Kimley nickel iron type, alkaline storage "B" battery has long since passed the experimental stage, and the purchase of one will solve your "B" battery troubles for years to come. There can be no sulphating or buckling of the plates. They are not harmed by short circuits, over-charging or standing idle and will hold their charge one to two years when standing idle. Will last from three to six months on one charge when used in the detector plate circuit and can be recharged in two hours from alternating current with the rectifier furnished with each battery. Will give you a quieter running set and improve your receiving range. They are ideal in your amplifier circuit and also for C.W. transmission. Will give you one and one third volts variation and in addition to the above and many other special features they are very attractive in appearance, being assembled in neatly finished oak cabinets and there is no creeping of the salts or solution. Let us ship you one on a ninety day money back Guarantee so that you can prove the above for yourself. Our prices include rectifier, salts for solution and full directions, nothing else to procure but two quarts of distilled water. Plain batteries with clips for voltage regulation 22 volts \$5.50, 32 volts \$8.00, 48 volts \$10.00, 68 volts \$12.00. Batteries with hard rubber panels and switches for voltage regulation as per the above cut. 32 volts \$11.00, 48 volts \$13.00, 68 volts \$16.00. Circulars and a partial list of satisfied users furnished upon request.

If you want "A" battery comfort, buy one of our Guaranteed KICO "A" storage batteries completely charged ready for use and furnished with rectifier to charge from alternating current at the following prices 6 volt \$19.00, 8 volt \$22.00, 10 volt \$25.00 all 60 ampere hours and will give years of service without having to send out to be recharged.

*Circulars furnished upon request.*

**KIMLEY ELECTRIC CO., 290 Winslow Ave., Buffalo, N. Y.**

**QST de ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Pa., successor to Shotton Radio Mfg. Co., of this city.**

We wish to announce that we will carry at all times, a complete line of parts, as well complete sets representing the leading manufacturers.

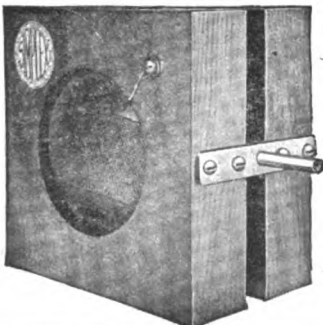
**Service - is our watchword.**

A Trial will convince you.

Send 5c. for our catalog of Parts

**ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Penna.**

## VARIOMETERS AND VARIOCOUPERS



These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base.

Varimeter as illustrated ..\$6.00

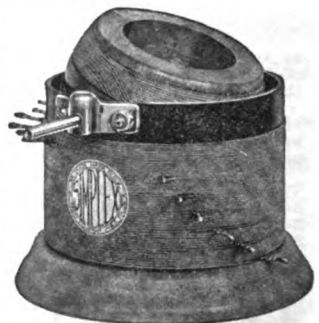
Vario-Coupler as illustrated 6.00

Round or Square Base

Get them at your dealer's.

**SIMPLEX RADIO CO.**

1013-15 Ridge Av., Phila. Pa.





You get the best RESULTS  
by using a

# Stromberg-Carlson Radio Headset

These fine instruments, made by a Company engaged in the manufacture of telephone apparatus for 28 years, bring in the long distance tones with accuracy and distinctness.

They give the fullest measure of enjoyment because of the quality of the tones. Convenient and comfortable. The construction of the Stromberg-Carlson Head Set allows simultaneous use by two observers.

## Head Set Receivers

Receivers are equipped with a one-piece bipolar permanent magnet, of high grade magnet steel; provided with phenol fiber spool heads, slotted soft iron pole pieces, corrosion proof diaphragm, enameled copper wire coils. All parts are encased in a receiver shell of cast non-magnetic insulating material, that is unaffected by either moisture or temperature changes. Each coil is wound to 500 ohms. The coils are connected in series. This gives a combined resistance of 2000 ohms.

## The Head Band

A head band is furnished of the spring wire type, covered with heavy brown webbing, correctly shaped, light in weight and comfortable to the operator. Knurled thumb screws are provided on both ends to permit locking the adjustment after it is once fitted to the head. There is also provision for separating the receivers which permits two observers listening in on a circuit simultaneously.

## The Cords

Each No. 2-A Radio Head Set is equipped with a 5-ft. brown silk moisture proofed, receiver cord which is forked in two branches, one branch for each receiver.

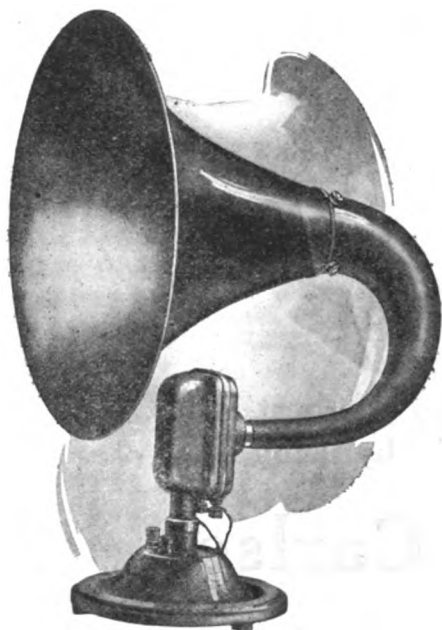
Price \$7.50 each f.o.b. Rochester, including two head set receivers, head band and forked 5-foot cord.

Send for our Free Bulletin No. 1030-Q, describing the No. 2-A Radio Head Set and other superior apparatus of our manufacture.

**STROMBERG-CARLSON TELEPHONE MFG. CO.**  
**ROCHESTER, N. Y.**

Branches: Chicago, Kansas City, Toronto, Address nearest office.

Complete your Wireless Outfit with a **BRISTOL LOUD SPEAKER**



TRADE MARK  
**AUDIOPHONE**

PATENTS PENDING DESIGN PATENT PENDING

for Radio - Phone  
**RECEPTION**

Can be used on 40 volt 2-stage amplifiers. Reproduces music and speech without distortion. No Batteries Required. Everyone can hear the wireless concerts, speeches, news, etc. A marvel of simplicity. Only one moving unit, comprising a diaphragm and an armature directly attached to it. Horn 15 inches diameter—compact, artistic design.

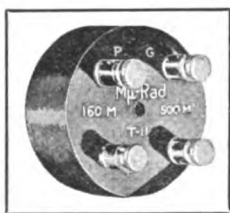
**PRICE COMPLETE .....\$40.00**

Made and Sold By

**THE BRISTOL COMPANY**  
Waterbury, Conn.

R. F. AMPLIFIER TRANSFORMERS

**MU-RAD**



|  |        |
|--|--------|
| TYPE T-11 for single or multi-stage .....    | \$6.00 |
| TYPE T-11a especially for second stage ..... | 6.50   |
| TYPE T-11b especially for third stage .....  | 7.00   |

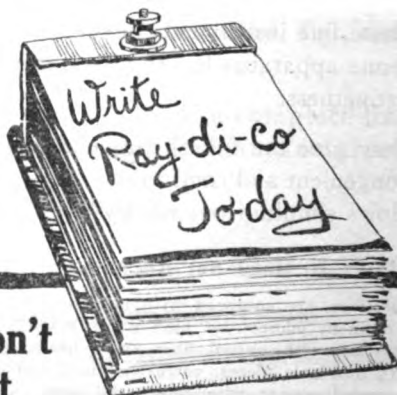
At your dealers or direct from

**MU-RAD LABORATORIES**

Incorporated

ST. LOUIS, MO., ASBURY PARK, N. J.

Distributors West of Mississippi River,  
THE BENWOOD CO., ST. LOUIS, MO.



**Don't  
Let**

Dissatisfaction and lost Radio business remind you next month, to place your orders with RAY-DI-CO.

**DO IT NOW!**

RAY-DI-CO ORGANIZATION USE THIS COUPON  
1547D North Wells St., Chicago, Ill.

Send me prices and information on the following Radio Apparatus:

Name .....  
Address .....



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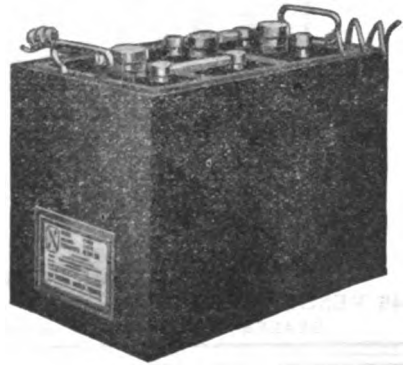
*Give Your Radio Set the Advantage of*

# WESTINGHOUSE

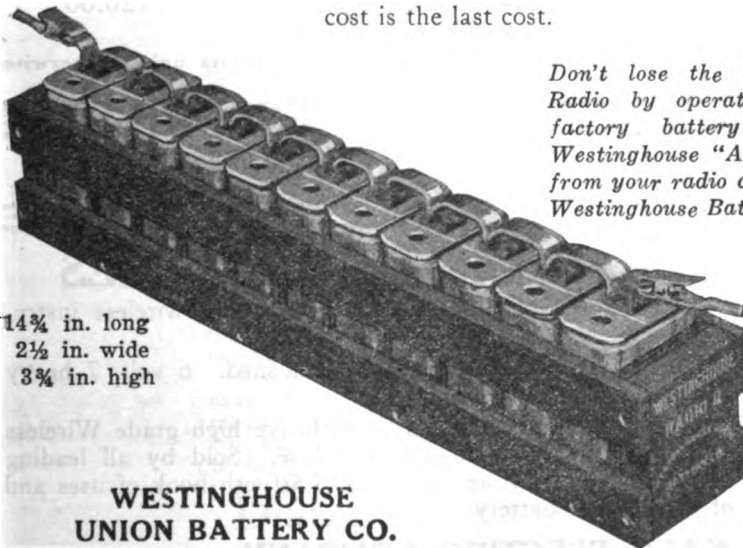
## RADIO BATTERIES



Westinghouse "A" Batteries are especially built for the peculiar requirements of radio work. They deliver a constant, dependable flow of low voltage current. They are built to give long, low-cost service. They demand a minimum of attention.



In the Westinghouse "B" battery you have a *storage* battery for "B" work—the latest development in radio practice. It has all the reliability and dependable performance of a storage battery and none of the disadvantages of a dry cell. The Westinghouse "B" gives a steady, continuous, noiseless service. It lasts indefinitely. When exhausted it is easily recharged. The first cost is the last cost.



14¾ in. long  
2½ in. wide  
3¾ in. high

WESTINGHOUSE  
UNION BATTERY CO.  
Swissvale, Pa.

*Don't lose the enjoyment of your Radio by operating under unsatisfactory battery conditions. Get Westinghouse "A" and "B" batteries from your radio dealer or the nearest Westinghouse Battery Service Station.*

*"The best  
Westinghouse  
can build."*

**OUT NOW**

**A REAL CALL BOOK**

# AMATEUR RADIO DIRECTORY

**CORRECTED TO MARCH 15, 1922**

Complete List of all Amateur Stations in the United States, including Special and Broadcasting Stations.

—also—

Notes on the construction of a complete receiving set.

Calibration of a receiving set without the use of a wavemeter.

**PRICE \$1.00 PER COPY**

Order from your Dealer—If your Dealer hasn't them, send direct.

**PUBLISHED BY**

**RADIO DIRECTORY AND PUBLISHING CO.**

**45 VESEY STREET,**

**Dept. A**

**NEW YORK CITY, N. Y.**

**DEALERS—Write for Proposition**

**DO NOT SEND STAMPS.**

## POPULAR AMRAD SPECIALTIES IN STOCK

|   |        |
|---|--------|
| S-Tube Rectifier, 20 watt, JUST OUT.....          | \$8.00 |
| Electrolytic Condenser, 38 Mfd. complete.....     | 8.00   |
| Vernier Variometer, unmounted.....                | 2.50   |
| Basket Ball Variometer, unmounted, with dial..... | 7.25   |
| Short Wave Set, Tuner 2596—Det--2 Stage 2634..... | 120.00 |
| and many other items                              |        |

Shipments guaranteed within 48 hours on receipt of money orders unless otherwise instructed

## RADIO EQUIPMENT and ACCESSORIES CO.

**388 Bridge Street  
Brooklyn, N. Y.**

**220 So. State St.  
Chicago, Ill.**

## KECO-RADIO STORAGE BATTERIES

Are the highest grade batteries built especially for wireless instruments.



Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristol" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, \$15.50 with book of uses and abuses of the storage battery.

**KALB ELECTRIC COMPANY**

**7323 MANCHESTER AVENUE,**

**ST. LOUIS, MO.**

# Radio panels

**H**AVE your panels made to your own specifications. Celoron Radio Panel Service assures you the highest type, best serving, best looking radio panels made, machined and engraved to your own individual specifications.

## <sup>CONDENSITE</sup> CELORON

**Grade 10**—the highest type of radio insulation that we produce—has a wide variety of uses in the radio field. It is extremely high in surface and volume resistivity, high in dielectric strength and low in dielectric losses. This material is particularly suited for panels because it machines easily, engraves beautifully and is extremely handsome in appearance. It is the grade we recommend, and has been approved by the Navy Department Bureau of Engineering.

Where economy is a factor we can supply panels made of Vulcanized Fibre Veneer. This material is made of a center section of hard, grey vulcanized fibre veneered on both sides with a water-proof, phenolic condensation product. It has a fine, smooth, jet black surface, machines readily, engraves nicely and is applicable for use in the construction of radio equipment where very high voltages at radio frequencies are not involved.

Celoron Shielded Plates (patent applied for) are made with a concealed wire mesh imbedded directly under the back surface of the plate. This wire shield, when properly grounded, very effectively neutralizes all "howl" and detuning effects caused by body capacities. Shielded plates are made in both Condensite Celoron Grade 10 and Vulcanized Fibre Veneer.

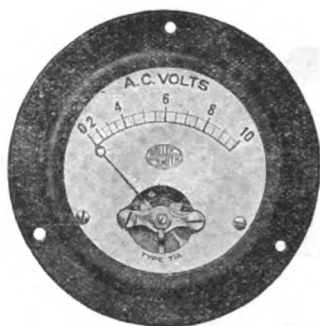
### Send today for our Radio Panel Guide

Are you an enthusiast? Write to-day for our Radio Panel Guide that describes these panels in detail—quotes prices—and tells you just what the panel you want will cost.

Are you a Radio Dealer? Get in touch with us. Learn how easily Celoron Radio Panel Service enables you to sell panels completely machined and finished to your customer's specifications. No waste, no bother. Write for our special Dealer Proposition to-day.

**Diamond State Fibre Company**  
**Bridgeport (near Philadelphia) Penna.**

In Canada: Diamond State Fibre Co. of Canada, Ltd., Toronto



Type T1A, Flush Model

## If You NEED a Voltmeter You PAY for it Whether you BUY it or not

**For Instance:** If you put too much voltage on the filament of your V.T. you burn it out. Result—a new tube, which costs about the same as a Roller-Smith voltmeter. So you see you do pay for the voltmeter whether you buy it or not.

Bulletin No. AG-10 tells you all about Roller-Smith voltmeters for reading filament voltage. It also describes a complete line of 3½" A.C. and D.C. instruments for all radio work. Send for it. It's Free.

*Roller-Smith instruments are sold by all good dealers.*

## ROLLER-SMITH COMPANY

Electrical Instruments, Meters and Circuit Breakers



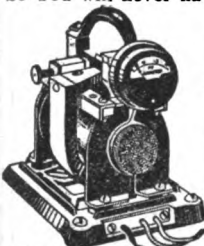
**MAIN OFFICE:**  
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**WORKS:**  
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*Offices in principal cities in United States and Canada*

## 10c. Charges 'A&B' Storage Batteries AT HOME WITH AN F-F Booster

So You will never have to give up, in disgust when



working a distant station. Is it not gratifying to feel that your filament battery will always be ready when you want it? You Know What it is like to have friends call to "LISTEN IN" & then find your battery dead. The AMMETER shows You the amount of Current Flowing. Both Waves of Current are rectified thru adjustable & easily renewable Carbon Electrodes, which maintain a constant efficiency & last indefinitely. Each F-F Battery Booster Type is in itself a Complete Compact Self-Contained & Portable Magnetic Rectifier & Charging Unit, for 105-125 Volt 60 Cycle A.C. which Operates Automatically & Unattended. Screw Plug in Lamp Socket, Snap Clips on Battery Terminals & watch the Gravity come up. PRE-WAR PRICES:

Bantam Type 6 Charges A 6 Volt Battery At 6 Amperes \$15  
Type B Charges 2 to 100 Volt Radio B Batteries \$15  
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Bantam Type 12 Charges 12 Volt Battery At 5 Amperes \$15  
Type 166 Charges 6 Volt Battery At 12 Amperes \$24  
Type 1612 Charges 12 Volt Battery At 7 Amperes \$24  
Type 1626 Charges Both 6 & 12 Volt Batteries \$36  
The Large Types are for heavy Batteries, or Where Time is Limited. Shipping Weights Complete 12 to 15 Pounds. Order from Dealer, or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage & Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge Batteries from Farm Lighting Plants & D.C. Circuits & for Group Charging & Wireless High Voltage Rectification. Ask for Free Full Wave Automatic F-F ROTARY Bulletin 31A

Order Now or Write Immediately for Free BOOSTER Bulletin No. 31  
The France Mfg. Co. OFFICES & WORKS  
CLEVELAND, OHIO, U.S.A.  
Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

# HERE

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Complete stocks carried for immediate shipment of the following apparatus:

Grebe Murdock  
DeForest Adams-Morgan  
Acme Radio Corporation  
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Federal Telephone & Telegraph Co.

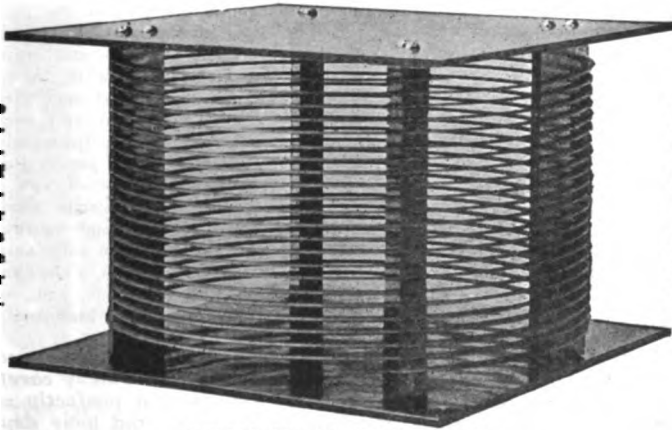
## FREE BULLETINS PRICE LISTS

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

**Nash Electrical Service Co.**  
Marshall, Ill.

# We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the **WIMCO INDUCTANCE** assures you of maximum results from your CW outfit. Its low resistance means greater antenna output.



WIMCO CW 100 INDUCTANCE

Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size \$10.00, Grid Coil \$2.00 extra.

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aerials at 200 meters wave length;

| Wave length  | H. F. Resistance |
|--|------------------|
| 150  | .71 ohms         |
| 200  | .85 ohms         |
| 250  | .95 ohms         |
| (effective inductance 80.5 microhenries at 200 meters) |                  |

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

**ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER.** We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price \$5.00 fully mounted and thoroughly guaranteed. **DEALERS—JOBBER WRITE.**

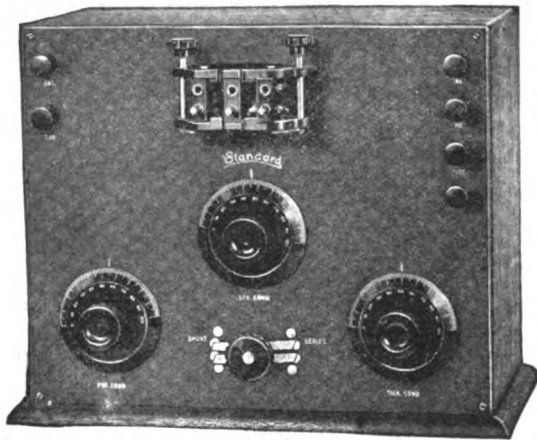
**REMLER APPARATUS—CUNNINGHAM TUBES—FROST REGENERATIVE RECEIVING SETS—CLAPP-EASTHAM AND FEDERAL PRODUCTS—HIPCO PLATE BATTERIES—WORKRITE VARIOMETERS AND COUPLERS—KLOSNER VERNIER RHEOSTATS—FADA APPARATUS—BRANDES AND BALDWIN HEADSETS**

## 8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

**JOBBER—MANUFACTURERS**

## THE STANDARD PLAN—"ASSEMBLED BUT NOT WIRED"



MULTIPLE WAVE TUNER

The Standard plan of distributing high-grade Radio instruments,—fully assembled but not wired,—is ideal for the experimenter who wishes to incorporate his own circuit and at the same time save the wiring cost. The Standard Assembling Co. does all the actual panel drilling and assembling, which is essentially machine work,—and leaves the wiring, which is hand work, for you to do. This offers you an average saving of 20% or more and is the only way in which you can secure correctly machine made instruments without paying for the expensive hand wiring, which you can do just as well. The multiple wave tuner shown here is an example of the Standard plan. It comes to you fully assembled but unwired for \$45.00, a clear saving of at least \$10.00 on what you would ordinarily pay for such a high-grade instrument.

*This tuner will be shipped anywhere in the United States upon receipt of one third the purchase price. Examine the instrument carefully and if acceptable, remit the balance. If you are not perfectly satisfied, simply return the instrument and we will refund your deposit. If you do not wish to order at once, send a stamped return envelope for our literature describing the complete line of Standard instruments.*

**STANDARD ASSEMBLING CO. 91 BRIDGE ST., N. Y. C.**

## Buy Your Sets and Parts from the Oldest Exclusive Radio House in New England!

— WE OFFER —

|  |               |
|--|---------------|
| USL STORAGE BATTERIES<br>6V 60-80 Amp Hour | \$15.         |
| UNIT "B" BATTERIES<br>45V Variable         | \$3.60        |
| PHONES—Standard make.                      | \$6. to \$15. |
| CRYSTAL DETECTOR<br>RECEIVING SETS         | \$20.         |

*We carry at all times a complete stock  
of standard parts at standard prices.  
Order from any standard catalog.*

**RADIO EQUIPMENT CO.**  
630 Washington St. Boston, Mass.  
MAKERS OF RADECO SAFETY FUSE

## A Complete Line of All Makes

# RADIO

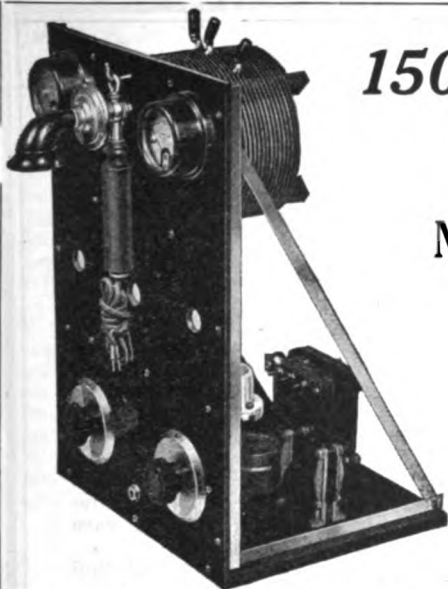
## SETS AND PARTS

| Receiving Sets   |          | Fada Rheostats    |        |
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| Aeriola Grand    | \$325.00 | Switch Arm Double | .75    |
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| Westinghouse RC  | 132.50   | Sockets           |        |
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| Holtzer Cabot    | \$8.00   | DeForest          | 1.00   |
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| Brandes Navy     | 14.00    | Crosley           | .60    |
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| Federal 52W      | 10.50    | For Dials         |        |
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| ohm              | 5.00     | General Radio     | \$2.50 |
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| ohm              | 6.00     | Bradleystat       | 1.75   |
| Variometer—wound |          | Kloesner          | 1.50   |
| on Bakelite      | 8.00     |                   |        |
| Bank-Wound       |          |                   |        |
| Inductance       | 4.50     |                   |        |

**JAMES H. JONES**

*Radio Apparatus*

94 Mass. Ave., Boston, 17, Mass.



# 1500 Miles With CW! 1100 Miles Voice!

Music Heard 40 feet from  
Phones by Stations in  
300 to 400 Miles Radius

These are actual results obtained by our testing station 9ZB, using this set, You can get just as good work out of it.

## The Benwood Wireless Telephone

*For CW, ICW, Modulated Buzzer and  
Voice Transmission*

This high class set is just the thing for your broadcasting and DX work. An ideal set for the local radio club or the more progressive amateur. Think of the range this set will give you! If centrally located, you will be heard in almost every state in the Union.

It is manufactured exclusively by and for the Benwood Co. and combines the best in material, workmanship and design.

### **Radiates 1-2 to 3 Amps.**

We guarantee that this outfit will radiate  $1\frac{1}{2}$  amperes on the average amateur antennae when assembled in accordance with our instructions. It will radiate 2 to 3 amperes when used with an antenna whose fundamental wave length is 225 to 275 meters. That is why you can get such wonderful results.

### **Specifications**

The set comes to you completely assembled with all parts mounted on panel, as shown, but not wired. Full instructions and wiring diagrams are furnished. You can wire it and start sending in less than an hour after you receive it.

The outfit is complete with motor generator, minus tubes, and consists of the following:—

Panel 12x18x $\frac{1}{8}$ , angle brass supports, hardwood base, 3 tube sockets, 1 power rheostat, 1 80 watt filament trans., 1 modulation trans., 1 CW inductance, 1 hand transmitter, 1 0-3 Radiation meter, 1 0-500 milliammeter, 1 21 plate condenser, 1 43 plate condenser, 1 tapped condenser, 1 L-300 choke coil, 1 2000 volt filter condenser, 1 10,000 ohm grid leak, plug and jack connection for microphone buzzer and CW, 1 600 volt 220 watt motor generator. Boxed for shipment, \$200.00 f.o.b. St. Louis, Mo.

### **Send for Catalog**

Send 10c in stamps for the new Benwood Radio Catalog comprising the latest Price Directory.

**THE BENWOOD CO., INC.,** 1114 OLIVE STREET,  
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"WORLD WIDE MAIL ORDER SERVICE"



The above photo shows our new 3 story building in the heart of the St. Louis business district. Our mail order department is complete in itself and we give you immediate service on all mail orders.

# Here at Last — The



## radio head set you have been waiting for-

Backed by years of experience in the making of voice reception apparatus this head set is the last word in unequalled distinctness, extreme sensitiveness and pure, clear tonal qualities.

Your receiving outfit equipped with this radio head set will assure you of maximum service in faithfully reproducing all broadcasted vocal and musical sounds.

The sanitary headband is self-adjusting, with a spring tension that automatically takes up the wear. The wearer is assured of the greatest comfort with minimum surface pressure. The removable interiors are entirely insulated from the case and allow for temperature changes.

Give yourself a treat—try them—you will find they are all we claim—and more.

### Superior Features—

Lightweight—12 oz.

Extremely Sensitive

No Distortion

Anchored Cords

Matched Receivers

Centered pull on Diaphragms

No hair catching projections

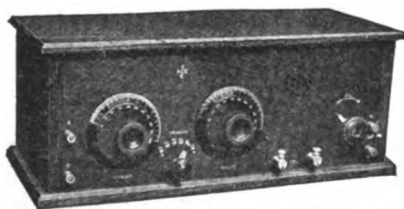
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Maximum Efficiency

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220 West 42nd Street, New York, N. Y.

## ACE "ACE RADIO CONCERT RECEPTOR" ACE



### Type TRU Concert Receptor \$50.00

(Licensed under Armstrong Patent 1,118,149)

This unit is especially designed for the efficient reception of Radio Telephone Concerts from even the most distant Broadcasting Stations. The ease with which this Receptor can be installed and the extreme simplicity of operation make it ideal for use by even the most in-experienced. No previous knowledge of radio necessary to secure results.

We stock a complete line of Radio Supplies and maintain a *prompt, reliable* Mail Order Service that reaches all over the world.

Send 5c in stamps for catalog to Dept. "D".

**The Precision Equipment Co., Inc.**

Manufacturers & Distributors of Radio Apparatus  
Peebles Corner, Cincinnati, Ohio

Cable Address

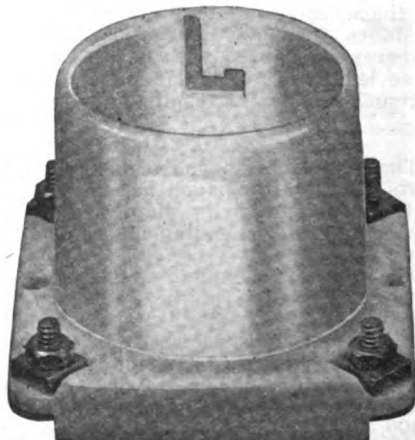
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WMH  
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## The Original - At The New Price

50 cents each



The original socket with the concealed bayonet slot.

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## Above All

Quality is the wave length to which the wise consumer tunes today, in his purchase of radio equipment. He buys quality apparatus because he knows it produces quality results—constant, unvarying efficiency under ordinary conditions, anywhere.

It has been the privilege of the Marshall-Gerken Company not only to manufacture quality wireless apparatus, but to show users the value of quality in radio instruments. They have expressed their ideal of quality in the precision required of their engineers in the making of the smallest as well as the largest part; quality construction is the key to the facility of operation of Marshall-Gerken apparatus; the factor of quality again predominates in the simplicity of the instructions by which the amateur as well as the professional obtains the highest utility from Marshall-Gerken equipment.

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**Progressive Distributors and Dealers: Write for our illustrated Booklet, you will find it exceedingly interesting.**

*The Marshall-Gerken Co.*

Quality **RADIO** Products

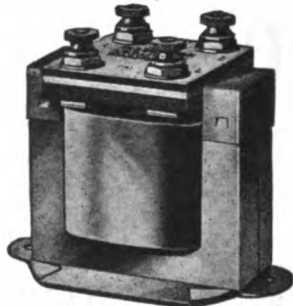
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Toledo, Ohio, U. S. A.

# THE THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMER

is now standard with many well known manufacturers  
That should be sufficient guarantee that it is right

**SHELL  
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**PRICE  
\$4.50**

Each transformer supplied fully mounted in an ingenious, nicked frame with substantial terminals mounted on a bakelite terminal board.

The terminal board is on the top, the only logical place for a terminal board. The transformer is wound with silk covered wire.

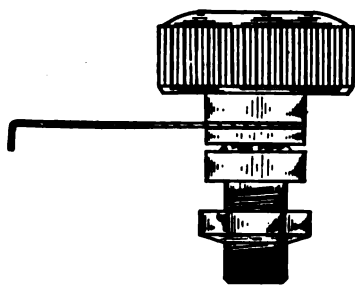
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SWITCHES, CONTACTS, BINDING POSTS,  
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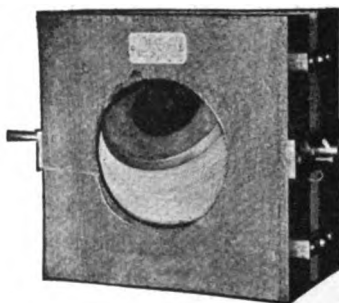
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**VARIOMETERS, complete . . . . . \$5.00**  
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Two Variometers and Variocoupler  
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**AEROPLANE ANTENNA WIRE**  
**\$1.00—Per Coil of 200 Feet—\$1.00**  
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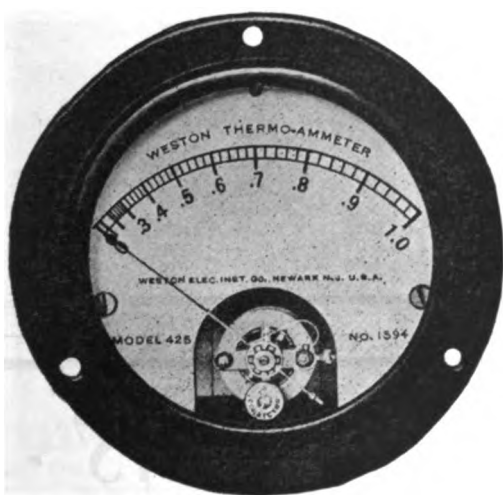
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"The House of Service"

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# ***"How Do I Come Through? I Can't Depend on My Ammeter!"***

You never hear such statements from users of the

## **Weston Thermo-Ammeter**



This Instrument has made the measurement of high frequency currents as simple and reliable as any ordinary electrical measurement.

It is free from all the objections and uncertainties of the "hot wire" types.

It is highly accurate; thoroughly compensated against temperature or working errors; it is instantly responsive; it has no zero error or lag, and is designed and built to give permanent satisfaction.

It is a truly scientific Instrument and is the most economical type that can be used in the antennae.

This Instrument is in service in many thousands of Transmitting Sets, including most governmental, commercial and marine outfits, and is now being bought in large quantities by amateurs and experimenters to replace unsatisfactory types.

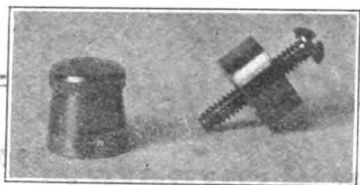
Complete information concerning this particular Instrument and the complete group of Weston Radio Instruments is contained in "Circular J." Write for it. If your dealer cannot supply your needs from stock, we shall be glad to do so.

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**158 Weston Avenue, Newark, N. J.**

**Branch Offices in the Leading Cities**

**ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS**



We are the Designers, Originators,  
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**The Bell Buoy Binding Post**

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**The Binding Post for Land and Sea.**

The Peer of all Removable Head Binding Posts. Has the Vise-Grip.  
Wire will not turn. We leave the Question of its Superiority to You

**15c EACH—12 FOR \$1.75 P.P. PREPAID.**

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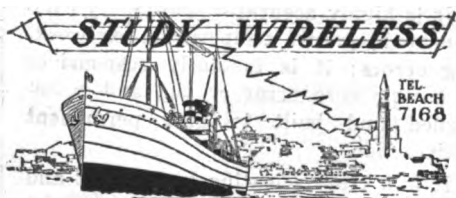
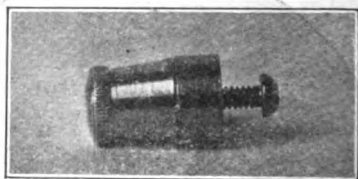
Amateurs Send for Circular.  
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**Star Cabinet & Radio Shop**

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**CORRESPONDENCE  
COURSE in CITIZEN RADIO**

giving complete non-technical instruction in  
fundamentals of Radio and practical explanation  
of "hook-ups" and a hundred details  
amateurs need to know.

*Send 25c in stamps for first lesson*

The surplus of experienced commercial  
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again in position to guarantee positions  
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**Leading Jobber !**

We are marketing the Radio Ma-  
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Standard Radio Merchandise at  
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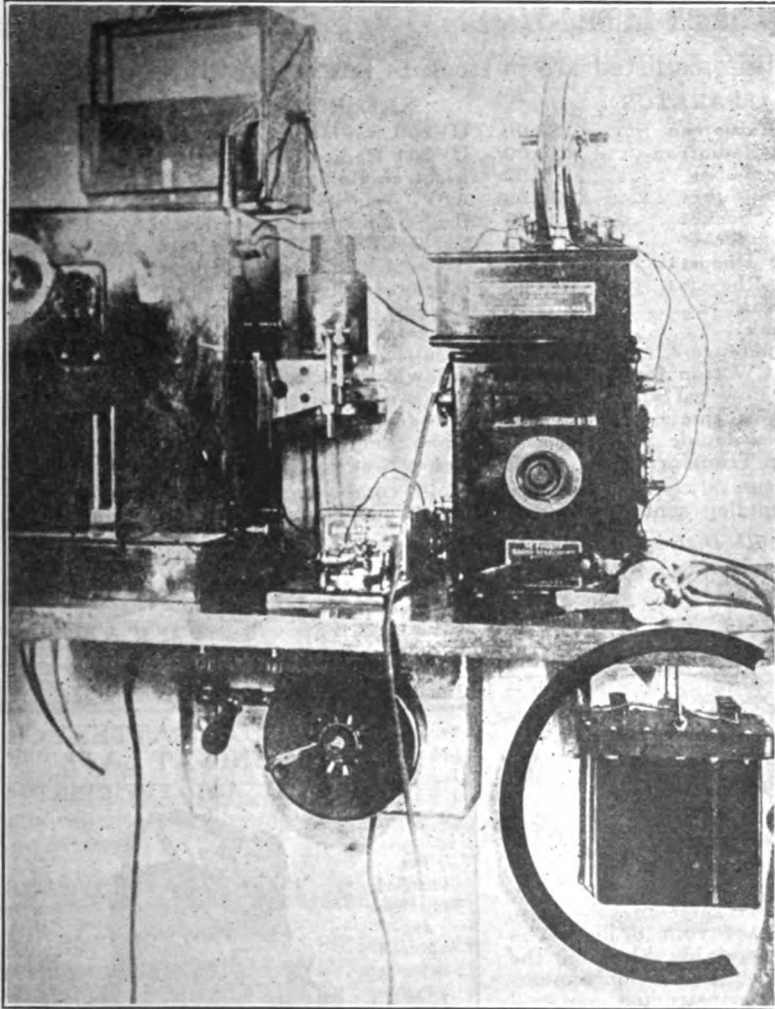
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"EXCLUSIVELY RADIO"

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**First  
Wireless  
Telephone  
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BATTERY  
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Extra heavy plates and separators permit continuous complete discharges at constant voltage without harm.

One piece hard rubber case insures against damage from leaks and is absolutely clean. Built by pioneers—1903-1922.

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**Largest Radio Stock In Mid-West**

**Immediate Deliveries**

All items listed are in stock in large quantities.

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| UR542 Porcelain Socket .....       | 1.00   |
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| PR535 Filament Rheostat .....      | 3.00   |
| PR537 Filament Rheostat .....      | 10.00  |
| UP1719 Grid Leak .....             | 1.10   |
| UP1718 Grid Leak .....             | 1.65   |
| Acme CW Inductance .....           | 8.00   |
| Acme 200 Watt CW transformer ..... | 20.00  |
| Acme 500 Watt Power Trans. ....    | 25.00  |
| Acme Choke Coils, single .....     | 6.00   |
| Acme Choke Coils, double .....     | 8.00   |
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| Electron Relay, detector .....    | 5.00   |
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| Grebe CR9 with amplifier .....    | 130.00 |
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| Baldwin Receivers type C .....    | 12.00  |
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| Acme Amplifying transformers ..   | 5.00   |
| Honey Comb Coils, all sizes       |        |

Inquire for monthly stock sheet, shows our complete stock each month. CW and radiophone catalog sent any address when four cents in stamps accompanies inquiry.

5th District Distributors for Ideal Apparatus Co.

# T & H Radio Company

**ANTHONY,**

**9ZAC**

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## HI-GEE PLUGS and JACKS

Now ready for delivery—

|             |          |               |
|-------------|----------|---------------|
| Jacks ..... | 80c each | <b>\$1.35</b> |
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Combination set of one plug and one jack. This is a special limited offer for short time only. We positively guarantee to ship these one hour from receipt of your order. The most efficient and serviceable plug on the market. Both units are attractive in appearance and are sturdily constructed.

## HI-GEE AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

Fully assembled and mounted. Made of the best materials. Correct ratio of primary and secondary turns. Silicon steel core. The best Audio Frequency transformer on the market, selling at a popular price

Special 30 day offer. **\$3.30**

We offer for immediate delivery the following: Parkin Dial Rheostats, Vacuum Tubes, Klossner Vernier Rheostats, Head Sets, HI-GEE Variable Condensers, Grid Leaks, HI-GEE Variometers & Couplers, Grid Condensers.

12 page loose leaf catalogue now ready

Write for your copy NOW

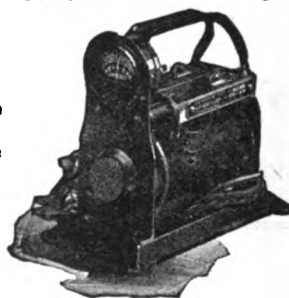
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## HI-GEE RADIO MANUFACTURING

**Marion, COMPANY Illinois**

## INDIVIDUAL BATTERY CHARGING AT LAST PRACTICAL AND EFFICIENT

For  
Charging  
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and  
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Lamp  
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Initial  
charging  
Rate  
6 volt  
Battery.  
10  
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**Sterling**  
Portable Rectifier

THE Sterling charges a nearly exhausted battery over-night for a few cents. Improved vibrating reed type, simple, effective and durable. One thumb-screw does all the adjusting. Automatically tapering charge safeguards against overcharging.

Price Complete - - - **\$18.00**

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Write for Bulletin giving full information.

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2834 Prospect Ave., Cleveland, Ohio.  
Over two million Sterling  
Instruments in use today.

# Meeting the Demand for Radio Sets

**I**T is natural that broadcasting, *carrying news, music, lectures, concerts and even grand opera* into the homes of the American people, should have created a concerted and impatient demand for radio sets and apparatus—especially the popular radio receiving sets.

If the demand for radio sets and apparatus had grown normally, the well-equipped and highly-organized factories supplying the Radio Corporation of America would now be producing an excess over the market requirements.

Under the present expansion program of the Radio Corporation of America it is quite possible that there will be a surplus production within six months.

## A Greatly Expanded Program

The factories manufacturing for the Radio Corporation of America are operating on a greatly expanded production program. *They are straining every nerve and muscle to meet the demand.*

It is not merely a question of men and raw materials. There are limiting factors in some of the delicate equipment parts, and even when all production is running evenly, new jigs, dies and tools must be especially designed, manufactured and installed before the production forces can be increased.

As a result of the efforts that are being made, it is expected that within the next few weeks considerable quantities of material will be shipped on orders already placed. This applies to all classes of radio sets and apparatus, and especially Radiotrons, Vacuum Tubes, etc., which are employed for reception.

The assurance can be given that every scientific, manufacturing, organizing and financial resource of the Radio Corporation of America is being used to meet the demand for radio devices.

We are working to the utmost, not merely to supply the demand, but to put into every set and every piece of equipment complete quality, and as much permanent satisfaction as a rapidly developing art will permit.

We are asking the aid of our distributors and dealers in explaining the capabilities and limitations of radio sets and apparatus, and we welcome their co-operation and indulgence, as well as that of the public itself, until the present expansion program is carried out.

A new R. C. A. Catalog, covering all the radio devices being manufactured for the Radio Corporation of America, will be ready for distribution within thirty or forty days. This catalog will contain timely and helpful information of great value to the wholesale distributor, the retail dealer, and the user of radio apparatus.



# ELWOOD RADIO HEADSETS

The seventeen years of practical experience in the making of telephones and receivers by this company, assures you of good design and workmanship.

Elwood headsets meet the exacting demands of all purchasers of radio units and parts. Both receivers operate in unison, insuring clear, harmonious and uninterrupted reproduction. Our absolute guarantee of the ohmage capacity of these headsets is your safeguard.



Receivers have metal case, highly finished. Headbands have sanitary fabric covering, fully adjustable. Complete set packed in attractive carton.

We are also manufacturers of Binding Posts, Contact Points, Jacks and Plugs for Radio Work.

**ELWOOD ELECTRIC CO. INC.**

Formerly Liddell Electric Mfg. Co.

2-4 Randall Avenue, Bridgeport, Conn.

## ANNOUNCEMENT

Doubleday, Page & Company announce to the readers of QST their new magazine—



It will be unique in the Radio field, in that it will serve the entire Radio Public—and not any single organization, manufacturers, or any other group.

It is not a competitor of QST, and we are sure that readers of QST will find much of interest in Radio Broadcast that they cannot find anywhere else.

Buy it at the news-stands—or better still—send a dollar for four months of the magazine on trial. 104 pages of interesting material.

Address—Subscription Manager.

**Doubleday, Page & Co.**  
GARDEN CITY, N. Y.

## ANNOUNCING

### Our Entry

INTO THE FIELD OF

## CITIZEN RADIO

AS

Manufacturers

OF

# REX

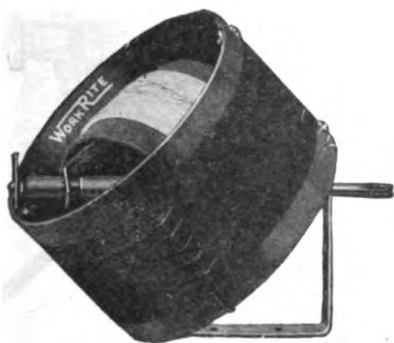
## Radio Apparatus

Ask For It At Your Dealers  
Dealers—We can make deliveries

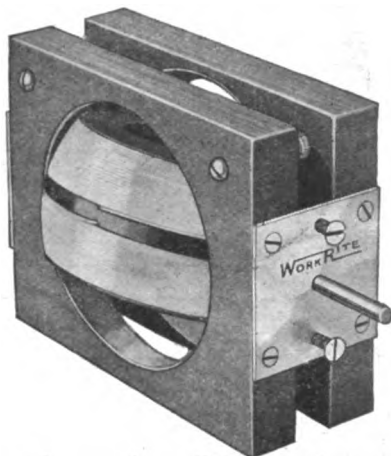
**Jenkins Mfg. Co.**  
4607 Ravenswood Ave.  
Chicago, Illinois



# "WORKRITE PRODUCTS WORKRITE"



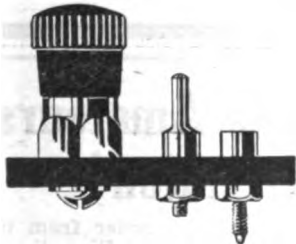
**Finest  
Material  
Finest  
Workmanship  
Finest  
Finish**



Here is the "Tuner Team" that radio fans have been going wild over wherever shown. Most dealers have their entire allotment sold before shipment is received. "They certainly do WorkRite" is the verdict of all users.

One WorkRite Variocoupler and two WorkRite Variometers are guaranteed to give you a tuner that cannot be excelled by anything on the market.

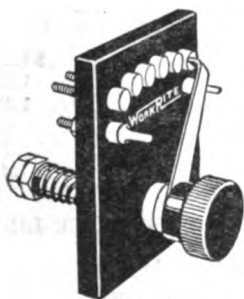
**WORKRITE VARIOCOUPLER OR VARIOMETER IN ATTRACTIVE  
BOXES \$6.00 EACH**



WorkRite Binding Posts ..... \$0.12

WorkRite Switch Points ..... .04

WorkRite Switch Stops ..... .06



Just what you want. Remove the parts and use the block as a template for drilling your panel. Put up in neat individual boxes. Complete WorkRite Switch Sets, \$1.00. Switch arm only, with bushing, 50c.

## TYPE "A" WORKRITE HYDROMETER

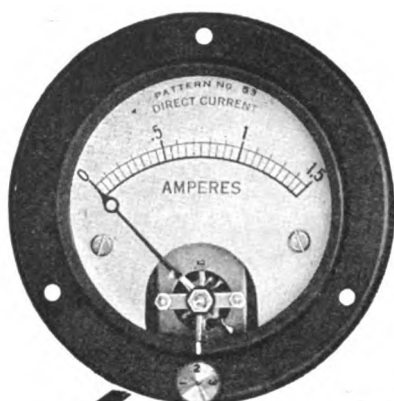
Double the life of your battery by giving it proper care. Fill and test it regularly with a WorkRite Hydrometer. Never let it become discharged below 1150, or it will soon be ruined. Full instructions for testing and care of battery with each "WORKRITE." Get one now! Price, \$1.00



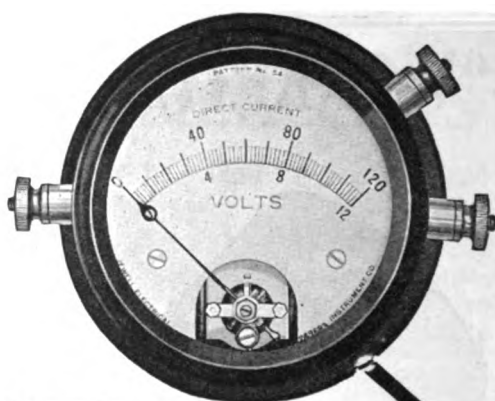
Insist that your dealer furnish a "WORKRITE." Accept no substitute. If he cannot supply you, we will ship direct by mail prepaid.

**JOBBER AND DEALERS—Write or Wire for Discounts**

**The WORKRITE Mfg. Co.,** 5603 Euclid Ave.  
Cleveland, Ohio.



No. 53



No. 54



## NEW RADIO INSTRUMENTS

Pattern No. 53 Triple Filament Ammeter has three self contained shunts with a switch for reading the current in the filament of any tube of a group of three without breaking the circuit. Also supplied as 0-10 voltmeter. Takes the place of three instruments.

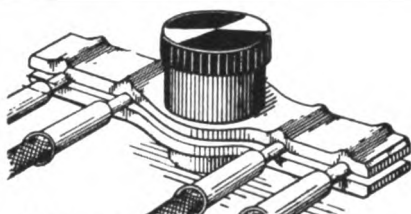
Price, 1.5 Amps. or 10 Volt. \$10.00

Pattern No. 54 double range portable voltmeter for testing "A" and "B" batteries under all conditions commonly used for receiving. Fully described in our new circular with our standard line of radio instruments.

Price, 0-12-120 Volts \$10.00

ORDER FROM YOUR DEALER

**JEWELL ELECTRICAL INSTRUMENT CO.**  
CHICAGO



### FOUR SETS OF PHONES!

**25c** will buy a set of Multiple Binding Post Connections (patent pending) which provide the only practical means of attaching as many as 4 pairs of telephone receivers to a pair of ordinary binding posts.

Dual connection set provides same connection in attaching Magnavox and outfit to storage battery.

Either set will be sent postpaid upon receipt of 25c in coin or stamps. Satisfaction guaranteed or money back.

**Portable Wireless Telephone Co**

Dep't B, Commercial Bank Bldg.,  
**STOCKTON, CALIFORNIA**  
Attractive Dealer's Proposition.

## Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

### SPECIAL!

|                             |        |
|-----------------------------|--------|
| Vacuum Tube Sockets.....    | \$1.25 |
| Rheostats .....             | 1.25   |
| 22½ Volt "B" Batteries..... | 1.50   |
| Rasco Dials .....           | .60    |
| Rubber Binding Posts.....   | .20    |
| Tested Galena .....         | .40    |

Lateral Wound Coils. All Sizes.

SEND 5c FOR OUR NEW PRICE LIST

**J. M. PAQUIN,**

THE ELECTRICAL SHOP

787 Queen St. West, Toronto, Ont.

## SHREVEPORT

THE HEART OF THE FIFTH DISTRICT  
We stock leading makes of—

### RADIO APPARATUS

MAIL ORDERS A SPECIALTY

**Shreveport Radio Supply Co.**

P. O. Box 600, 222 Texas St., Shreveport, La.

## SPECIAL PRICES THIS MONTH

On Grebe, Clapp-Eastham and  
Amrad Sets

**MASSEY RADIO COMPANY**

The Radio Store, Winchester, Va.



## **SIGNAL WIRELESS APPARATUS IS BUILT COMPLETE IN SIGNAL SHOPS**

Heed the warning of the radio expert who says—be careful, Mr. Radio Beginner, to prove the quality of your Radio equipment **before** you buy it. Ask who built it—who uses it—how does it compare with other makes at or near its price!

**Signal Wireless Apparatus** is built complete in Signal factories, by Signal workmen, following tests and developments by Signal and other expert Radio Engineers in the Signal Radio Laboratory. The name "Signal" is the guarantee of satisfactory Radio Service.

Write today for literature and name of nearest dealer.

**Signal Electric Manufacturing Company**  
**Menominee, Michigan**

# HYGRADE SPECIALS

*save you money!*

|  |        |
|--|--------|
| 22½ Volt Cyclone Small B. Battery ..                 | \$0.90 |
| 22½ Volt Cyclone Large B. Battery ..                 | 1.60   |
| 45 Volt Cyclone Large Variable B<br>Battery .....    | 2.75   |
| 22½ Volt Large Eveready Variable B.<br>Battery ..... | 2.50   |
| Radio Service V.T. Sockets .....                     | .80    |
| Bakelite V.T. Sockets .....                          | .69    |
| 3 inch Bakelite Dials .....                          | .75    |
| 100 ft. #14 hard drawn copper aerial<br>wire .....   | .45    |
| 100 ft. 7 stranded copper aerial wire ..             | .75    |
| Binding Posts Rubber Cap per doz. ..                 | .75    |
| .0005 M.F. Grid Condensers .....                     | .25    |
| .002 M.F. Phone Condensers .....                     | .25    |

## MARKO STORAGE BATTERIES

|  |         |
|--|---------|
| 6 Volt 40 Amp. Guaranteed 2 yrs. ..                  | \$10.00 |
| 6 Volt 60 Amp. Guaranteed 2 yrs. ..                  | 13.50   |
| 6 Volt 80 Amp. Guaranteed 2 yrs. ..                  | 17.00   |
| 6 Volt 100 Amp. Guaranteed 2 yrs. ..                 | 21.00   |
| Western Electric 2200 Ohm Head Set<br>Complete ..... | 14.00   |
| Eveready 0 to 10 Voltmeter, Pocket<br>size .....     | .75     |
| Variable Grid Leak ½ to 3 Megohms ..                 | .70     |
| Electrode Ball Insulators. Each, ..                  | .28     |
| Per Dozen .....                                      | 3.00    |
| Arkay Loud Speaker .....                             | 4.25    |
| Jacobus Lightning Arrestor .....                     | 1.75    |

We do Not Charge For Crating. The Above Batteries are fully charged when Shipped.

*The Above prices are F.O.B. New York.*

## HYGRADE ELECTRICAL NOVELTY COMPANY

41 West 125th Street,

New York City

# PSOULIESO

Does not mean anything, but if you want a word that means satisfaction in high-grade radio apparatus, remember

**“RADIO  VOX”**

*Highest grade apparatus only. Ask those who know.*

**Scientific Engineering Association**

817 Main St.  
Cincinnati, O.

 **THE O.W.L. RHEOSTAT**

An instrument of real Value, NO THERMO-ACTION resulting in distortion because all parts are made of the same resistance alloy throughout.

**PRICE - - \$1.00**

1012 Ogden Ave.,

N. Y. City

**RADIO CENTER  
SRC  
OF THE SOUTH**

**SOUTHERN RADIO CORPORATION**  
Radio Engineers and Jobbers

905 Realty Building.

Charlotte, N. C.

# New "Read 'Em" Binding Posts

16 Styles

Antenna

Ground

Condenser

Tickler

Variable Condenser

A—Battery—

A—Battery +

B—Battery—

B—Battery +

Plate

Detector

Phone

Secondary

Primary

Grid

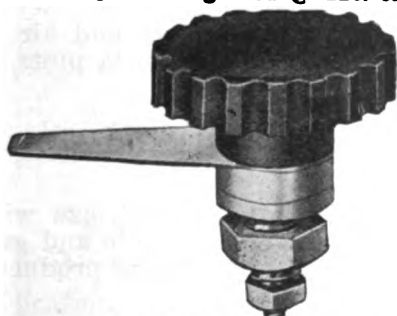
Filament



Complete Post and Knob 15c each

The enormous demand for these "read 'Em" binding posts, prompted us to put in a large stock to take care of our friends. Our stock is complete.

We are in equally fine position to fill orders promptly for binding posts made up of exactly the same high grade material and workmanship—the same in every way, without the knob engraved @ 12c. each.



SWITCH ARM TYPE S. A. 3

Price .....\$ .50 Each

Knob—1 1/4" Knurled Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 1—Price.....\$ .40 Each

Same as above with 1" radius knob.



SWITCH ARM TYPE S. A. 4

Price .....\$ .50 Each

Knob—1 1/4" Fluted Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 2—Price.....\$ .40 Each

Same as above with 1" radius knob.

Send Us Your Orders Now

Orders will be shipped the day they are received. Send in your order early.

## THE KUEBLER RADIO COMPANY

125 Boody Bldg.

Toledo, Ohio



**N**O wireless receiving set is complete without the Magnavox Radio.

**A**TACHED to any commercial receiving set, the Magnavox Radio reproduces every sound in full volume and marvelous clearness.

Magnavox Radio, the loud-speaker, that has revolutionized the use and enjoyment of wireless telephony.

*Ask your dealer to demonstrate, or write us for descriptive booklet.*

**The Magnavox Company**  
Oakland, California  
New York Office: 370 Seventh Ave.

*Radio brings it,*  
**MAGNAVOX**  
*tells it.*

# IRVINGTON

## Radio Products



### RADIOCEL TUBES

Black seamless impregnated tubing in all lengths and diameters, with  $\frac{1}{8}$ " wall, for Tuning Coils, Loose Couplers, Variocouplers. Most economical tube form for all type of sets, for winding forms, at one-quarter the price of Bakelite.

### RADIOLAC

Insulating and finishing varnish for wound forms. Will set and insulate all wires and air dry in 15 minutes. In  $\frac{1}{4}$  pints and up.

### IRVINGTON FLEXIBLE WOVEN TUBING

To fit all standard size wires, in four colors, made and guaranteed by us, large production capacity.

Prompt shipment—high grade insulation goods sold at quantity production prices. Prices in any quantities.

**Sales Office and Factory**

**Irvington**  
**Varnish & Insulator Co.**  
Irvington, N. J.

# What Do You Want To Know About Radio?

Thousands of radio fans are availing themselves of the opportunity to get detailed information about radio from us, through our free Radio Bureau of Information. Let us have your questions!

You can see all there is to see concerning radio, at our new show rooms, 227-229 Fulton Street, New York City. The official opening date is set for Saturday evening, April 22, 1922. A special feature of this official opening will be a dance, by radio music.

## Complete Receiving Sets \$15.00 to \$300.00

We carry all the leading makes of apparatus, viz: RADIO CORPORATION, WESTERN ELECTRIC, GREBE, PARAGON, AMRAD, DORAN, ACME, MURDOCK, WESTINGHOUSE, BRANDES, FIRCO, FEDERAL, and GENERAL RADIO.

## Largest Retail and Wholesale House of Radio Supplies in the East

Watch the next issue for full details of the new Western Electric Loud Speaker, including Two-Stage Power Amplifier.

When in town, visit our library, which includes technical books on both wireless and electricity, and all popular radio publications. Questions will be answered by experts who are fully acquainted with both electrical and wireless theory and practice.

*Send 10c for Our Latest Illustrated Catalog*

# American Electro Technical Appliance Co.

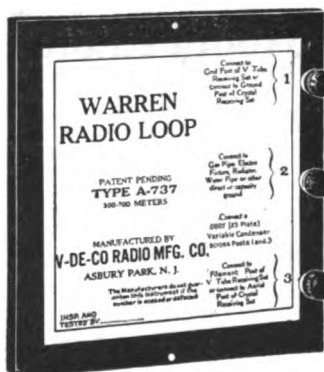
227-229-235 Fulton Street,

New York City

# Warren Radio Loop

NO  
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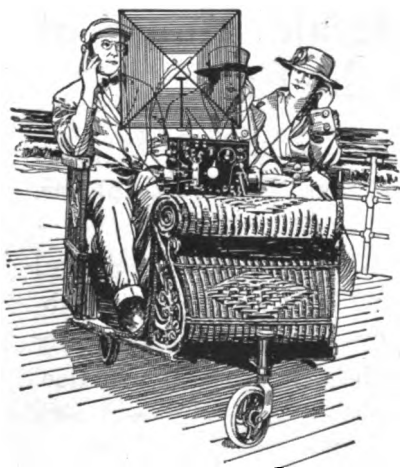
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If Dad says—  
"NO AERIAL ON THIS HOUSE"  
don't allow his QRM to worry you but  
purchase a

## WARREN RADIO LOOP

The LOOP that made the Radio Roller Chair famous on the Boardwalk at Asbury Park, N. J. is just the thing for an apartment or den. Is light in weight and easily portable. Is produced under a new principle of winding. Is wholly enclosed, thereby protecting the winding. Is used in place of an outside aerial. Is adapted for receiving in moving vehicles. Takes the "tic" from static. Eliminates all danger from lightning. Can be used with any receiving instrument. Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on "Wireless Age" and "Radio News" and featured in many other magazine and newspapers in the United States.

Send your order through your dealer or direct to us with his name.

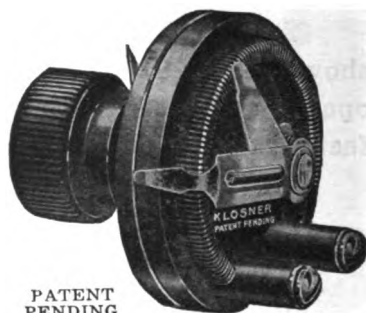
Type-A-737 (300-700 meters) .....\$10.00  
Type-A-7236 (175-1000 meters) ..... 12.00

## V-DE-CO RADIO MFG. CO.

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. AIOI

# MAKE NO MISTAKE THE KLOSNER VERNIER RHEOSTAT



is the only Vernier Rheostat made having the exclusive feature of using but

## ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name KLOSNER moulded on the base.

Your dealer has them or send direct to us.

**PRICE \$1.50**

Shipping weight, One pound.  
A two cent stamp brings interesting literature.

Made only by the Originators.

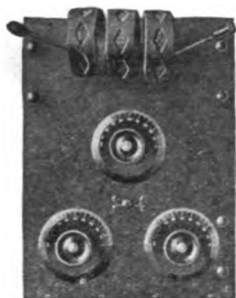
## The Klosner Improved Apparatus Company

Dept. Q4

2024 Boston Road, New York City  
N. Y.



# Type "Q" Receiver



## AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....\$35.00

## Duck's New Radio Catalog No. 16



Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.

### 275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed.

The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of

worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

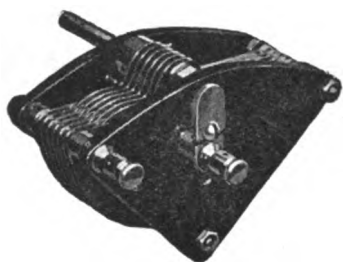
The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

## The William B. Duck Company

243-245 Superior Street

Toledo, Ohio



## HORNE VARIABLE CONDENSERS

The Variable Air Condenser with the "straight line" capacity variation. A large area substantial plate is used in the construction of this condenser, so that the multiplicity of plates used in the cheaper types is avoided.

Horne Variable Condensers are assembled with solid Bakelite end supports and turned brass spacers made to Micrometer gauge, and are provided with handsome nickel plated binding posts.

The laboratory type is enclosed in a polished nickel plated brass tube and can be used as an oil condenser at all leading Jobbers.



**Horne  
Manufacturing Co.**  
243 Mercer St., Jersey City, N. J.  
Manufacturers of Radio Products

## CRYSTAL DETECTOR STAND

Nickel plated  
or brass  
finish

No. 1201—\$1.50  
Tested Galena in  
Wood's metal 20c.

Get prices  
for other  
instruments  
and parts



With Screws and  
Washers for Bottom



No. 33  
6c. ea.



No. 30  
4c. ea.

Cuts of Contacts & Binding Posts represent original size



No. 71 7c. ea.



No. 64 7c. ea.



No. 71 7c. ea.



No. 75 7c. ea.



No. 75 7c. ea.



No. 71 7c. ea.



No. 71 7c. ea.

No. 7160 7127 7512 7594 7138 6647 71 7c. ea.  
For 100—  
\$1.80 \$1.70 \$1.40 \$1.20 \$1.30 \$1.20 72 larger  
8c.

If nickel finish is desired add 50c. for 100  
More than 50 styles of Binding Posts and other parts  
made by us and carried in stock.

Shaft solidly em-  
bedded to Knob,  
cannot work loose  
45c. Prepaid



Nickel plated  
or brass finish

Any style Lever up  
to 1 3/4 in. radius.  
Guaranteed not to  
work loose here  
Nut does not bind this part,  
but shoulder on shaft.  
Continental Electric Co.  
117 East 129 St. N., N. Y.

# **The Wholesale Radio Equipment Co.**

*Says*

## **DEALERS**

### **“Sample Our Service”**

*We Have On Hand For Delivery*

**TUSKA POPULAR RECEIVER**

**Regenerative  
Type 224**



**Price  
\$35.00**

**This outfit is ready for tubes, phones and batteries. It is COMPLETELY MOULDED. Ideal for expert or beginner. Two knobs: one for wave length; the other, for amplifying. Type 224 has stood the test of public trial.**

**DEALERS:**

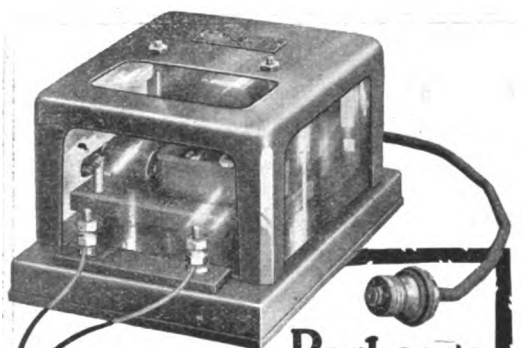
**Orders filled promptly for this outfit, also other standard sets and parts.**

**WRITE FOR PRICE LIST.**

## **THE WHOLESALE RADIO EQUIPMENT CO.**

**26 WILLIAM ST., NEWARK, N. J.**

***“Wholesale Exclusively”***



## Recharge Your Battery at Home

Don't be without the use of your Radio Receiving Set while your battery is being charged by some Service Station. Get a *Valley Charger* and charge your battery right at home at one-tenth the usual cost.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick tapering charge which just exactly charges your battery, but cannot over-charge or harm it in any way. This *Valley Charger* has no troublesome bulb and will charge your automobile battery as well as radio battery.

Satisfaction Guaranteed. If your local distributor cannot supply you, write direct to

### VALLEY ELECTRIC COMPANY

Department Q, St. Louis, Mo.

- - - Mail the Coupon - - -

Valley Electric Co., Dept. Q, St. Louis, Mo.

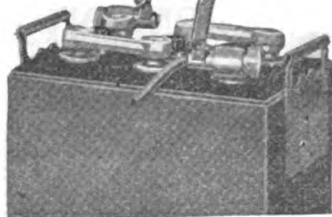
Gentlemen: I am enclosing money order (or check) for \$12.00 for which send me a Valley Battery Charger with black metal case. \$15.00 for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, will return it and get money.

Name \_\_\_\_\_

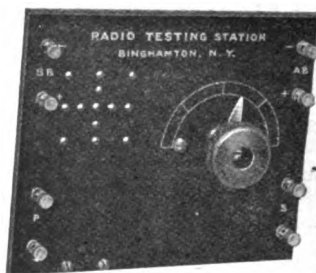
Address \_\_\_\_\_

Town \_\_\_\_\_

**\$12 and \$15**  
F.O.B. St. Louis



## Install this RTS Standard Detector Panel



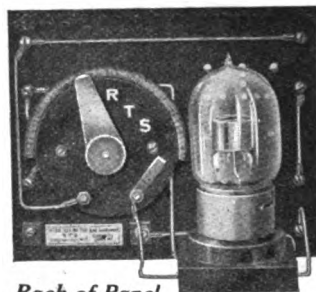
Front of Panel

**ONLY  
\$5.95**

**Assembled**

(Without tube)

**Prepaid by  
Insured  
Parcel Post**



Back of Panel

Here is a correctly designed panel made of best grade Formica. Its signal strength is unequalled by any other tested in our laboratory. The exclusive use of silver plated wire greatly increases its efficiency.

We guarantee the RTS Detector panel to be exactly as represented and will refund your money if you are not satisfied.

Order **TODAY** before the price goes up.

### RTS BUSHING LEVER

This Bushing Lever is well designed and beautifully finished. The knob is the well known Marconi type. Spring lever is 1 1/4" long with ground ends insuring smooth adjustment. A guide bushing raises the lever to proper height for all switch points.

**PRICE 60c.**

### New Catalog and Signal List

Send for new illustrated catalog containing list of signal abbreviations 10c. postpaid.

### RADIO TESTING STATION

Dept. Q-5, Sturgis St. BINGHAMTON, N. Y.

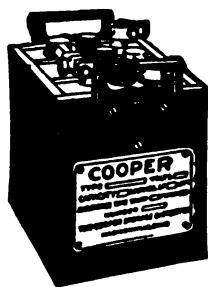
## RADIO GALENA CUBES

**Perfect and Sensitive  
Direct from Mine**

**Sizes—Twelve and Twenty-five  
Cents**

Discounts in quantity orders

**Empire Electric Machinery Co.**  
401 Penn. Ave., Joplin, Mo.



**Guaranteed**

**Wireless**

**Batteries**

6-V. 40-A.....\$9.20

6-V. 60-A.....11.15

6-V. 80-A.....13.80

# Highest Grade RADIO EQUIPMENT

Best results can be obtained by using Radio Equipment & Supplies sold by us—we carry following makes of equipment:

Radio Corporation, Amrad, Westinghouse, Clapp-Eastham, Grebe, Precision, Crosley, Murdock, Rhamstine, Chelsea, Acme and others—Also, Atlantic and Pacific—Tubes.



**No. 53-W and 52-W  
Head Telephones**

**No. 53-W Federal  
Head Telephones  
2200 ohm \$8.00**

**No. 52-W Federal  
Head Telephones  
3200 ohm \$10.50**

## ORDER BY MAIL

Enclose Certified Check or Post Office Money Order—Include Postage for all over 1 pound—Prompt Deliveries

Detector Tubes .....\$5.00—\$6.00

Amplifiers Tubes ...\$6.50—\$7.50

Amplifying Trans-  
formers .....\$3.50—\$5.00

Rheostats .....\$1.25

Vernier Rheostats ..... 1.50

Tube Sockets ..... 1.00

Variable Condensers \$3.50—\$5.00

Knobs and Dials complete.. 1.00

Receivers .....\$6.00—\$15.00

Robbins & Myers—Motors—  
Generators

Variocouplers .....\$6.90—\$8.50

Variometers .....\$6.10—\$7.50

Switch Points ..... .05

Switch Levers ..... .50

Binding Posts ..... .10

B-Batteries, Burgess .....\$3.00

All Size Magnet Wire ..... .

..In Spools .....\$0.30 to \$0.90

Aerial Wire, Solid ..... .60#

Aerial Wire, Stranded .... .75#

Formica Panels, Per Sq. in. — .02½

All Sizes of Mahogany Cabinets

# THE DALIE ELECTRIC CO.

“THE HOUSE OF SERVICE”

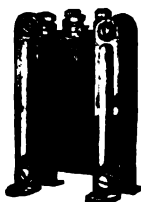
SPRINGFIELD, OHIO

RADIO DEPT. QST

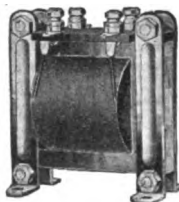
126-130 SO. LIMESTONE ST.

# JEFFERSON

## Amplifying Transformers



No. 45



No. 41

Secure maximum amplification by using Transformers designed especially for the new audiotron and Radiotron Tubes.

Jefferson Transformers are the result of exhaustive tests of every kind, and are positively unequalled for audibility and amplifying power.

Our No. 45 Navy Type is the most widely used transformer in the country. If you are not getting maximum amplification try it and note the improvement, the absence of distortion and the clearness of tone.

The No. 41 Transformer is also a very popular type. It is wound with No. 40 wire while the No. 45 is wound with No. 44 wire. Otherwise the construction is identical. The highest grade 36 gauge Silicon Steel is used for the core. The Primary Resistance of the No. 41 is approximately 900 ohms, of the No. 45 approximately 1800 ohms. Secondary Resistance: No. 41, approximately 5000 ohms, No. 45 approximately 8500 ohms.

Transformers are mounted in attractive brass frames with genuine Bakelite panels which carry the primary and secondary terminals. These Transformers are also furnished unmounted.

Send for Radio Bulletin

## Jefferson Electric Mfg. Co.

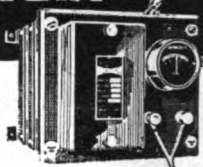
425 S. GREEN ST., CHICAGO, ILL.

# HOMCHARGE

## YOUR BATTERY

for A Nickle

A perfect rectifier at last, fully automatic and fool-proof in every respect. It can be operated by anyone.



## The HOCHMARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is selfpolarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replaceable as a unit for \$1.00. The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than \$100.00. Bulletin 628 proves it. Ask for your copy.

Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. Cannot injure battery—will last a lifetime—approved by underwriters—satisfaction guaranteed. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price—\$18.50. (\$20 West of the Rockies.)

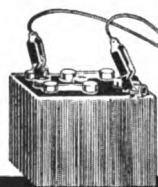
### ATTENTION MOTORISTS:

Send for special bulletin 58 showing how easy it is to "HOMCHARGE" your battery.

THE AUTOMATIC ELECTRICAL DEVICES CO.

127 West Third St., Cincinnati, Ohio

Canadian Distributors  
**POWLEY & MOODY**  
Ltd. Toronto



## FROM CAT WHISKERS UP—

We can supply everything that's best in Radio. 1 or 101 of any article to user or dealer. Same day shipments.

*Inquiries are welcome*



**DISTRIBUTORS**  
Wholesale and Retail  
WESTINGHOUSE MURDOCK  
RADIO CORPORATION  
BRANDES, FEDERAL, DeFOREST  
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA

## THE CHAIN STORAGE BATTERY FOR RADIO WORK

Meets your needs in the best possible way by supplying a battery with ruggedness and reliability as its main points of merit. The feature of the inside cover prevents a too rapid evaporation of the liquid contents.

6 VOLT 60 AMPERE .....\$14.00

Battery shipped fully charged f.o.b. from factory in Missouri. Eighteen months guarantee for the plates is made possible by thirty years of research in battery construction.

**H. D. MATTHEWS**

495 Jefferson St.,

Milwaukee, Wis.

## DO YOU GET THE SAME SOUND IN BOTH EARS?

When unmatched receivers are used, the signals will sound differently in each ear. You naturally and unconsciously favor the receiver giving the loudest response. The value of the other receiver is entirely lost—it is worse than useless. To give maximum efficiency, receivers must be matched perfectly in tone. That is the reason you should insist on Brandes *Matched Tone*\* Receivers. Have you ever stopped to figure out how much signal strength you lose in an ordinary pair of 'phones? Send 5c for Catalog F.

Standard Since 1908

**C. Brandes, Inc.**

Room 721,

237 Lafayette St.

New York

Chicago Office  
33 South Clinton St., Chicago  
Illinois

Australian Agents  
International Electric Co.  
55 Courtenay Place  
Wellington, New Zealand

*Member Radio Section Associated Manufacturers of Electrical Supplies.*

\*Reg. U. S. Pat. Office.

# BRANDES Matched-Tone HEADSETS

### NEW MOTORS

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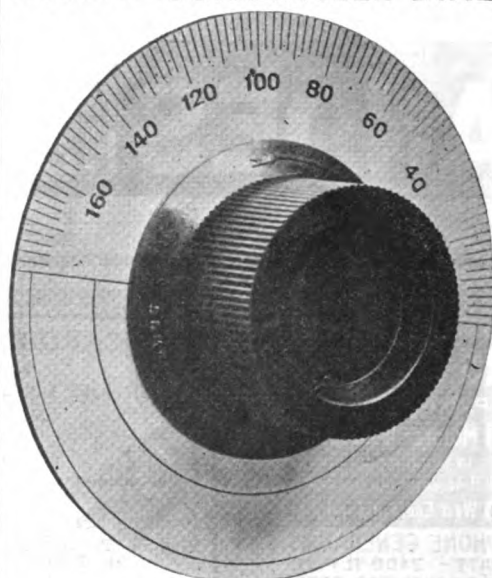
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### The Radiohome Receiver



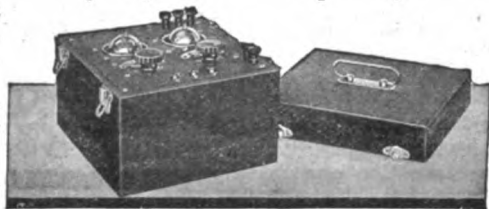
The Radiohome Receiver

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Every amateur is frequently being asked for advice as to what set should be purchased for the reception of radio telephone programs of music, news and stories. Many an amateur hesitates to recommend standard amateur equipment as his friends would be confused and bewildered by the array of controls on such a set.

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The Radiohome Receiver has a simple, two-slide tuning circuit with a range of 145-800 meters, a vacuum tube detector, and grid leak and rheostat. The price—less tube, batteries, receivers and antenna—is \$36. In a cabinet that is identical in size and finish with the cabinet of the Radiohome, is the DT-800, two-step amplifier. Three phone jacks are embodied in this instrument for detector, 1st step and 2nd step. Less tubes and batteries the price is \$35. We believe you will find no other set on the market to compare with this combination for the reception of radiophone programs by the newcomer in the field.



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Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 10th of month for succeeding month's issue.

**EDISON B BATTERY ELEMENTS.** Make your own. Can be recharged and lasts for years. 200 ampere hour A batteries, guaranteed, \$35.00. Harry Morrell, 52 Goffe St., New Haven, Conn.

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**A REAL STORAGE BATTERY BARGAIN.** Edison six cell 10 volt 225 ampere hour battery in first class condition \$45.00. P. Harwood, 657 54th St., Milwaukee, Wis.

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**SSP SPARK SET** 1KW Acme transformer 220 volt \$28.00. .01 Dubilier condenser new type \$28. Brownwood spark gap complete \$28. Complete set \$78. Terms cash. A. G. Kiser, Fairmont, W. Va.

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**OAK CABINETS,** Beautiful French polish, hinged covers, complete with 1/2" formica panel. Sizes 6"x10" and 6"x14", depth 7 inches. Prices \$8.30 and \$10.00. For other sizes write for estimates. The L. & B. Radio Shops, Dept. Q, 6195 McMillan Ave., Detroit, Michigan.

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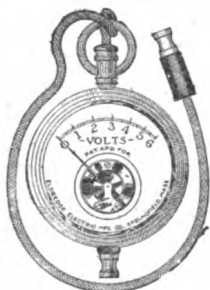
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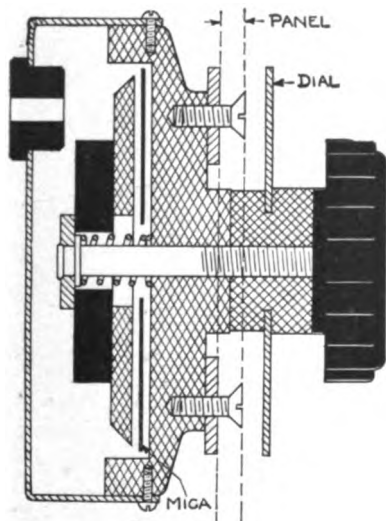
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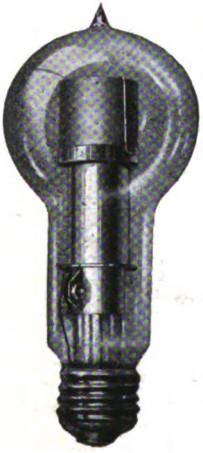
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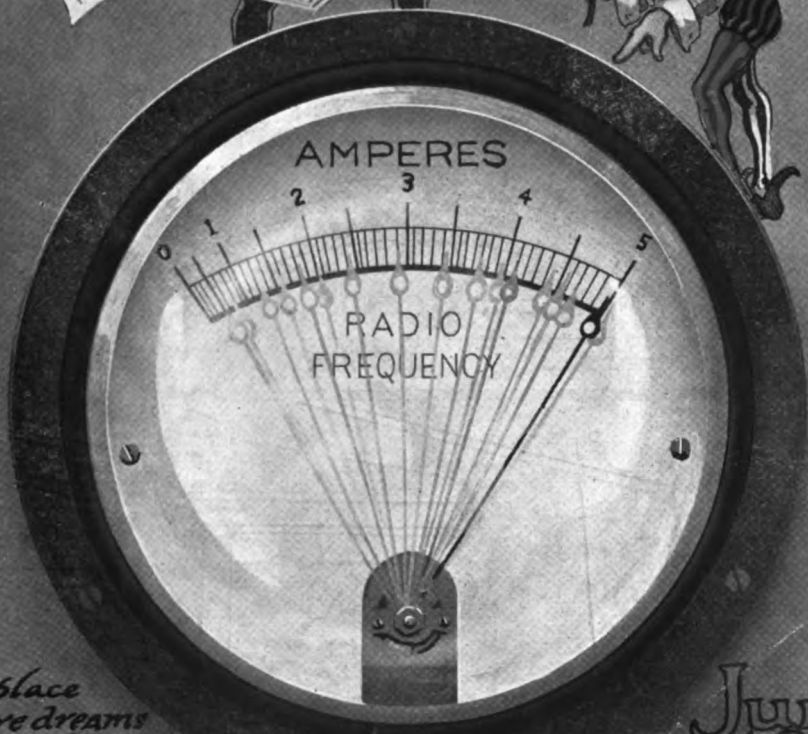
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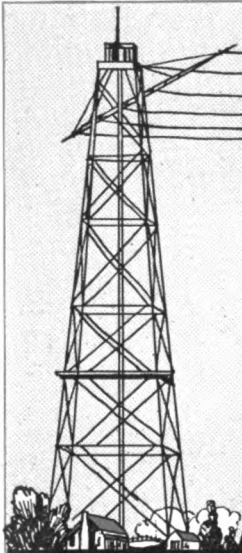
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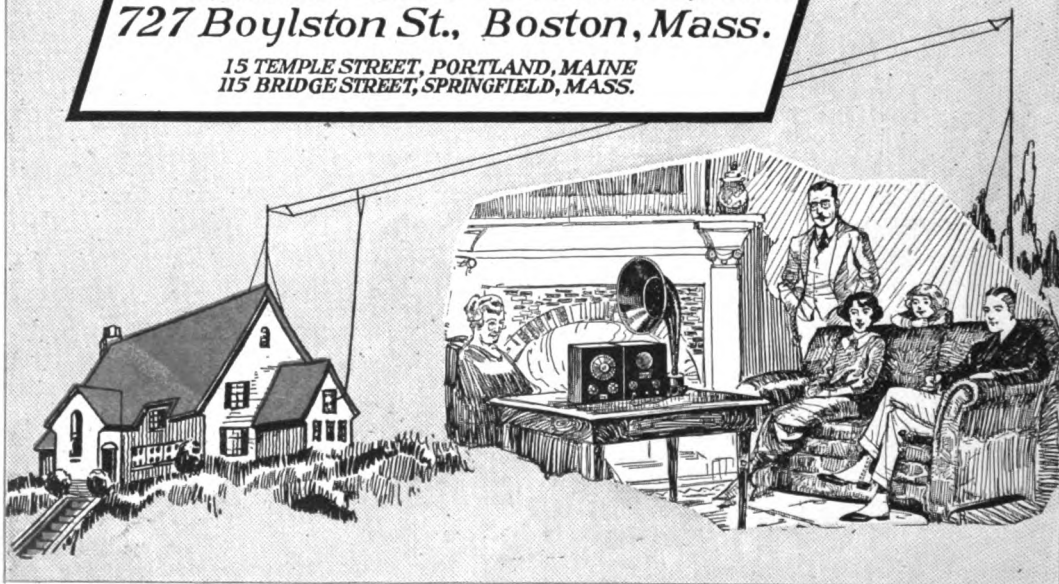
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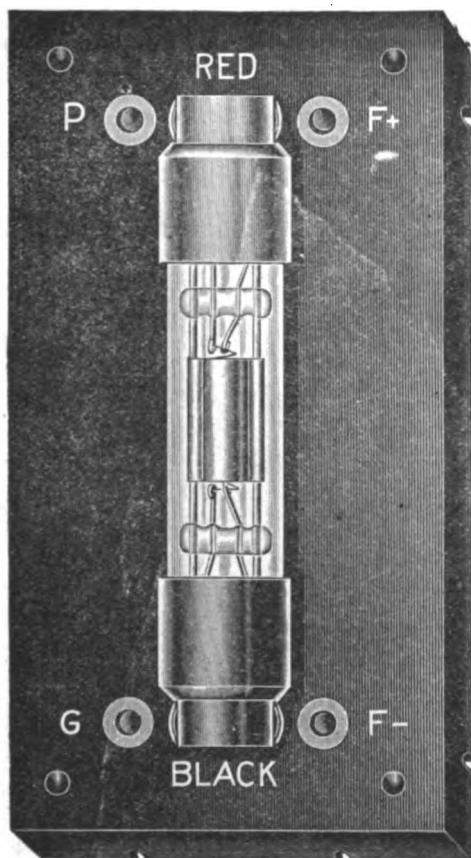
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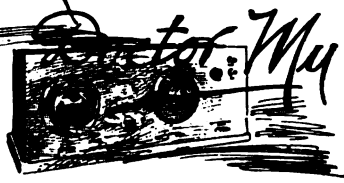
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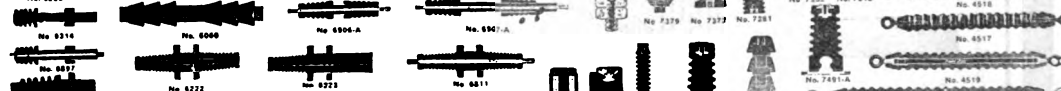
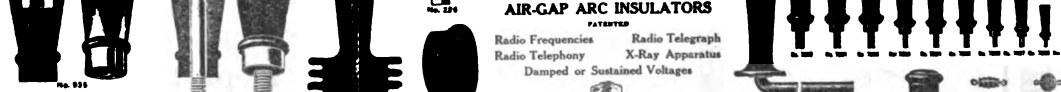
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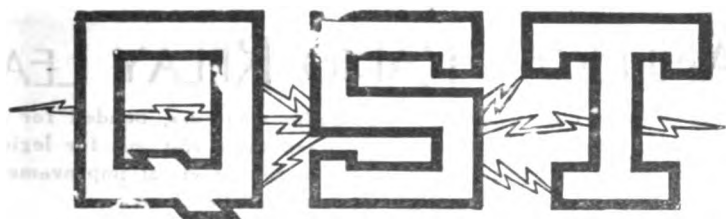
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# The Official Organ of the A.R.R.L.

VOLUME V.

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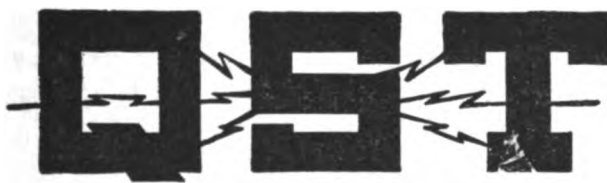
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A Magazine Devoted Exclusively to the Radio Amateur

## Power Factor--Some Whys and Wherefores

By F. C. Blake\*

QST readers will remember the "Power Factor" argument which has been raging in amateur circles for more than a year, entangling not only us amateurs but many of the engineers who strode in to assist us. Many stimulating conflicts between the "Unities" and the "Zeros" have disfigured our QST pages and still the controversy was unsettled. Now, however, we are pleased to present an article by Prof. Blake which we believe will decide the question for all time.

Prof. Blake is a teacher and consequently has a beautifully clear style of presentation. The article looks fearsome with its "math" but it is not as difficult as it appears at first blush. We are grateful to Prof. Blake for clearing up this subject and feel that every amateur can read his article with profit.—Editor.

HAVING been asked by the Editor for an expression of opinion on the discussion concerning power factor in wireless circuits originally raised by M. West (QST, Feb. 1921, p. 21) I gladly comply in the hope that possibly I may render the situation somewhat clearer. I have read the whole discussion with considerable interest, primarily because I believe it is my business as a teacher to help if possible those who are not trained to think in mathematical symbols to understand the physics of the things they deal with especially when as here it would appear that the books say one thing (power factor unity) and every radio operator knows (?) another.

What the books say is that when we have a coil and a condenser in series with each other and with an *impressed* sine-wave electromotive force (Figure 1), when the capacity and inductance of the circuit are so chosen as to balance each other and thus produce resonance—the so-called "voltage resonance" whereby the current in the circuit is in phase with the *impressed* voltage—then the power factor is unity, the value of the current at resonance being

a maximum, viz.,  $\frac{E}{R}$ .

Furthermore, the books say that when we have a coil and a condenser in parallel with each other but in series with an *impressed* sine-wave electromotive force (Figure 2), then resonance occurs (the so-called "current resonance") at the fre-

quency given by the equation  $\omega' = \frac{L - CR^2}{CL^2}$

and at resonance the line current is in phase with the *impressed* voltage and the power factor is unity, the value of the current at resonance being a minimum, viz.,

ERC

Mr. Anderson (QST, July 1924, p. 16) is right when he says that for either series or parallel resonance the resonant frequency occurs when  $\omega' LC = 1$  provided the resistance is negligible but he is wrong when he says that the voltage across the series circuit is zero and the current is infinite at resonant frequency while with the parallel circuit the voltage across it at resonance is infinite and the current zero. Isn't it rather that in either case the voltage across the circuit is  $E$ , the impressed voltage?

When the books tell us that the power factor is nearly unity in either of the above circuits if  $R$  is small compared to  $\omega L$  or to

$\frac{1}{\omega C}$  they mean to have us take the voltage

and current both of sine-wave form and they expect us in determining power factor to insert our voltmeter across  $E$  and in Figure 2 to insert our ammeter between  $E$  and  $C$ .

The apparatus referred to by Mr. West in which apparently the power factor was zero was the ordinary closed circuit of a small power spark transmitter with a rotating spark-gap (Figure 3). As in-

\*Professor Physics Dept., Ohio State University

licated an ammeter was inserted at  $A_2$  and an equivalent spark gap was inserted across the primary of the oscillation transformer at  $V_2$ . It is of course well known that an equivalent spark gap is a measure of maximum voltage and not of effective voltage and it is obvious that one cannot determine the effective voltage from the maximum voltage unless he knows the form of the voltage-wave.

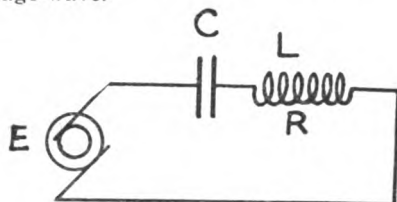


FIG. 1

In the absence of knowledge of the wave-forms of current and voltage I take them as sinusoidal. Now the books tell us (see for instance Morecroft, "Principles of Radio Communication") that the closed oscillating circuit, including the secondary of the power transformer and the condenser and the primary of the oscillation transformer, is in tune at audio frequency with the alternator, while the part of this circuit through the spark-gap, the condenser and primary of the oscillation transformer is also in tune at radio frequency with the antenna.

Now suppose for the sake of simplicity that all parts of our transmitter set are 100% efficient and let us take the power input to be 768 watts, the case cited by Mr. West in his reply to Mr. Stone (QST, April 1921). Call the power factor of our two audio circuits  $\cos \theta_1$  and  $\cos \theta_2$ , and of our two radio circuits,  $\cos \theta_3$  and  $\cos \theta_4$ . Then if  $e_1$  and  $i_1$ ,  $e_2$  and  $i_2$  are the effective values of the voltage and current in the primary and secondary of the audio circuits, while  $e_3$  and  $i_3$ ,  $e_4$  and  $i_4$  are the effective values of the voltage and current in the primary and secondary of the radio circuits, we have

$$e_1 i_1 \cos \theta_1 = e_2 i_2 \cos \theta_2 =$$

$$e_3 i_3 \cos \theta_3 = e_4 i_4 \cos \theta_4 = 768 \text{ watts} \quad (1)$$

Now the wattmeter inserted in circuits 1 or 2 would read 768 watts. Assuming the radio frequency current in circuit 3 is prevented by choke coils from getting back into the power transformer we can say that on the assumption of no ohmic loss the voltage across the primary of the oscillation transformer is equal to that across the condenser  $C_1$ . Moreover, the energy in the condenser  $C_1$  when fully charged is equal to the energy in the inductance  $L_1$  when the current thru it is a maximum.

$$\text{We have accordingly } L_1 \omega = \frac{1}{C_1 \omega} \quad (2)$$

and

$$\frac{1}{2} L_1 I_1^2 = \frac{1}{2} C_1 E_1^2 \text{ or } \frac{1}{2} L_1 i_1^2 = \frac{1}{2} C_1 e_1^2 \quad (3)$$

where  $I_1$  and  $E_1$  are respectively the maximum values of the radio frequency current and voltage respectively in this circuit,  $e_1$  and  $i_1$  being effective values. Since the spark gap distances are arranged to break down for a voltage only slightly lower than the full voltage across the condenser, in the audio circuit 2 we have the energy in the condenser  $\frac{1}{2} C_2 E_2^2$  distributed between the secondary of the power transformer and the primary of the oscillation transformer. Thus

$$\frac{1}{2} C_2 E_2^2 = \frac{1}{2} L_2 I_2^2 + \frac{1}{2} L_2 I_2'^2 = \frac{1}{2} L_2 I_2^2 \quad (4)$$

where  $I_2'$  is the audio frequency current through ammeter  $A_2$  and  $I_2$  the radio frequency current through the same ammeter. It would appear at first sight as if the ammeter  $A_2$  ought to read abnormally high due to this double current but this is not correct for during any one half cycle less than one fourth of the cycle is low frequency current followed by another fourth of damped high frequency current. The actual reading of the ammeter  $A_2$  will be less than the ideal reading  $I_2$  (as read by ammeter  $A_2$ ) given by the sine-wave form assumed. In other words

$$I_2 > \frac{I_2'}{2} + \frac{I_2}{2}$$

Since the two radio circuits are tuned to each other we have

$$\frac{1}{2} L_2 I_2^2 = \frac{1}{2} C_2 E_2^2 = \frac{1}{2} L_4 I_4^2 = \frac{1}{2} C_4 E_4^2 \quad (5)$$

Now assume a wave length of 600 meters. Then

$$600 = 1885 \sqrt{L_2 C_2} = 1885 \sqrt{L_4 C_4} \quad (6)$$

Take  $C_4$  to be .0001 and  $C_2$  .001 microfarads, then  $L_4 = 450$  and  $L_2 = 45$  microhenries. If

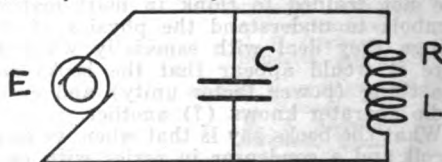


FIG. 2

now  $i_2 = 100$  amperes then  $e_2$  would equal 21200 and  $E_2 = \sqrt{2} e_2 = 30000$  volts which is what the maximum voltage was across the equivalent spark gap used to determine  $V_2$  in the case cited by Mr. West.

Now Mr. Stone, in agreement with all the text books, says that in tuning a circuit to resonance the radio operator is balancing the inductive and capacitive reactance against each other so as to produce unity power factor with the Joulean resistance as the only impedance. In that case, as the Bureau of Standards states in its telegram of reply to the Chicago convention, the current is then in phase with the impressed voltage. But in radio circuit 3

the voltage across the primary of the oscillation transformer is *not* the *impressed voltage at all*. The books tell us (see for instance Morecroft, pages 295 and 303) that the two audio circuits 1 and 2 can be replaced by a single circuit consisting of a generator in series with an inductance and capacity (Figure 1 of this paper—remember no resistance assumed). For this circuit the *impressed* voltage is that of the generator, the voltage across the condenser is  $90^\circ$  ahead of the impressed voltage, the voltage across the coil is  $90^\circ$  behind the impressed voltage. But the voltage across the primary of the oscillation transformer is (in the case cited) 21200 volts effective or 30000 volts maximum and it is the same voltage for the audio circuit 2 as for the radio circuit 3.

The books tell us (e.g., Morecroft, page 299) that the power given to a condenser

$\frac{CVN}{2}$

is  $\frac{CVN}{2}$  where  $V$  is the voltage to which

the condenser is charged,  $C$  its capacity and  $N$  the number of sparks per second. If our alternator has a frequency of  $\frac{1}{2}$  cycles, then our condenser of capacity .001 microfarad raised to a voltage of 21200 volts would have a power of 225 watts given to it, which is also the power put into the primary of the oscillation transformer,  $\frac{1}{2}LPN$ . But we had 768 watts available according to Mr. West, less than a third of which was needed if our apparatus had been 100% efficient throughout.

Now Morecroft (p. 294) states that the efficiency of a spark transmitter varies from 30 to 60% with the average 40%. That is, the power in the antenna is 40 per cent of the power input in the generator. Assuming our transmitter 40% efficient we would need 563 watts input where we had 768 watts. Had Mr. West's ammeter had a greater range than 100 amperes he would have found that with a spark transmitter 40% efficient his current would have read 117 instead of 100 amperes with 768 watts input.

In the above discussion the efficiency of our apparatus was taken as 100%. On this basis what would have been the reading of an ammeter in the antenna circuit and what would have been the maximum voltage of the antenna wires with respect to ground?

We have  $\frac{1}{2} L_i i_i^2 = \frac{1}{2} L_a i_a^2$  and we took  $i_i = 100$  amperes. Hence  $i_a = 31.6$  amperes. We have further  $\frac{1}{2} C_i E_i^2 = \frac{1}{2} C_a E_a^2$  and we found  $E_i$  to be 30000 volts, giving  $E_a$  to be 95000 volts. It is manifest that a ratio  $\frac{C_i}{C_a} = \frac{L_i}{L_a} = 100$  say instead of 10, would have given  $E_a$  300,000 volts and  $i_a$  10 amperes.

Let us now get back of the point at issue. Is the power factor of a radio circuit unity or zero? The books tell us that power factor is the ratio between the wattmeter reading and the product of the readings of the voltmeter and ammeter. Since it is very often desirable to know what is the power consumed not in a whole circuit but in some portion of it, no one can criticise if we talk about the power factor of a given portion of a circuit. For instance, if I want to measure the power consumed in a condenser I put the current coil of the watt-

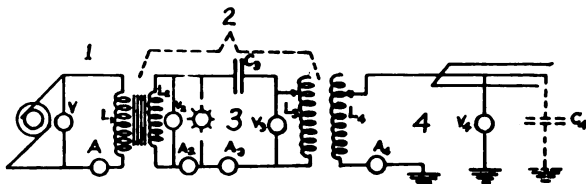


FIG. 3

meter in series with the condenser and the voltage coil across the condenser. If I now put an ammeter in series with the current coil of the wattmeter and an electrostatic voltmeter across the condenser I can determine the power factor of wattmeter reading

the condenser as  $\frac{\text{wattmeter reading}}{\text{volt-amperes}}$  provided

the wattmeter reading is corrected at low power factors for the effect of reactance in the voltage coil of the wattmeter. In this case I will find it to be almost zero for a good condenser, which we ordinarily express by saying that the current through the condenser and the voltage across it are in quadrature. Similarly if I want to determine the power loss in a coil of wire I will find the power factor small for a coil having its resistance low compared to its reactance, the current through the coil and the voltage across it being again  $90^\circ$  apart, only this time the current lags. If I now put a condenser in series with a coil and in series with an impressed E.M.F., I can balance the inductance of the coil against the capacity of the condenser so that if I put the voltage coil of the wattmeter across the impressed E.M.F., the current coil of the wattmeter, being in series with the ammeter inserted in the circuit (I now have a whole circuit instead of a part of one), a voltmeter also being inserted across the impressed E.M.F., then the power factor of the whole circuit

as given by  $\frac{\text{wattmeter reading}}{\text{volt-amperes}}$  will be

almost unity. Had the voltmeter and the voltage coil of the wattmeter been across the condenser or the coil then the power factor would have been very low (nearly zero) and the wattmeter reading divided by the square of the ammeter reading would have given me not the effective re-

istance of the entire circuit but of the condenser or of the coil.

Suppose now that I seek to investigate the power factor of all or a part of a second circuit connected indirectly to the first one by means of a transformer. This second circuit (circuit 2, Figure 3) will contain the secondary of the transformer, a condenser and another coil in series. This circuit is tuned to the frequency of the impressed E.M.F. of the primary circuit. I will first put the voltage coil of the wattmeter and the voltmeter across the secondary of this power transformer. In the primary circuit we have the voltage across the primary of the power transformer equal to the impressed voltage

$$\omega L$$

multiplied by the factor  $\frac{R}{\omega L}$  where  $L$

$$R$$

is the inductance of the primary and  $R$  is the resistance of the circuit. At resonance this is known to be many times the impressed voltage provided  $L$  is large and  $R$  small. The voltage across the secondary of the power transformer is stepped up from that across the primary, hence it is of the order of 10000 volts on open circuit. But on closed circuit the voltmeter when placed across this secondary of the power transformer will read not the induced voltage in the secondary but this quantity minus the counter E.M.F. of the secondary due to the current flowing in the circuit. Now the inductance  $L_s$  is always very great compared to the inductance  $L_p$ , hence the counter E.M.F. in  $L_s$  is great and the voltmeter reading  $V$ , may be very low (on the assumption that the radio-frequency currents in circuit 3 are prevented from circulating in  $L_s$  by the interposition of choking coils). Now the ammeter  $A$ , will read higher than  $A$ , so we will say it reads 140 amperes. Since the only things in cir-

cuit 2 that consume power are the resistances of the different parts of the circuit the voltmeter  $V$ , is apt to read some value between 0 and 50 volts on closed circuit. For the sake of clarification we have assumed our apparatus 100% efficient, hence the power factor of circuit 2 would necessarily be unity and the voltmeter when placed across  $L_s$ , would accordingly read 5.5 volts.

If I now pass to circuit 3, the first of the radio frequency circuits, a voltmeter put across the condenser or the primary  $L_p$  of the oscillation transformer will read 21200 volts and if put across the spark gap it will read only slightly less. Thus the power factor of circuit 3 would then be

$$\frac{768 \text{ watts}}{21200 \times 117 \text{ volt-amperes}} = 0.00031.$$

21200 x 117 volt-amperes

Passing to circuit 4, the second circuit of radio frequency, our transformer being considered 100% efficient the power factor of circuit 4 would necessarily equal that of circuit 3, viz., 0.00031.

Let us now review our four circuits in the light of equation (1) except that we will now try to allow roughly for the energy losses as we pass from one circuit to another. In circuit 1 we had 768 watts which for convenience we will say gave  $e_p = 110$  volts,  $i_p = 8$  amperes and  $\cos \theta_p = 0.87$ . In passing to circuit 2 we will assume the transformation 90% efficient and hence take  $e_s, i_s, \cos \theta_s = 671$  watts. Now we take  $i_s$  to be 140 amperes and  $e_s$  may well be as low as 8 volts. This would make  $\cos \theta_s = 0.60$ . For circuit 3 we will take the efficiency of transformation 64%. We have then  $e_s, i_s, \cos \theta_s = 429$  watts and with  $e_s$  21200 volts and  $i_s$  117 amperes this makes  $\cos \theta_s$  equal to 0.00017. Calling the efficiency of transformation between circuits 3 and 4 70% we have  $e_s, i_s, \cos \theta_s$



This hasn't a thing to do with Power Factor—it's the new First District Radio Inspector, Frederick Charles Kolster, who, with his parents, is busily checking up decrements and things. Bad stations had better watch out!

=300 watts. If we take  $e$ , 212000 volts and  $i$ , 10 amperes,  $\cos \theta$ , comes out 0.00015. Thus a numerical calculation shows the power factor for each of the two audio circuits to be nearly unity while for each of the two radio circuits it is nearly zero.

Now how do these conclusions check up with the telegraphic information sent the Chicago Convention by the Bureau of Standards? Since a transformer may be thought of as a generator and since in the generator circuit there is often a condenser in series or parallel with the generator, we can say for either of our two audio circuits 1 and 2, Figure 3, that we have capacity reactance and inductive reactance balancing each other leaving the current in phase with the impressed voltage; hence the power factor is unity. On the other hand the two radio circuits 3 and 4, Figure 3, may be said to be "freely oscillating" circuits whereas 1 and 2 were "forced oscillating" circuits, therefore there is no such thing as an impressed E.M.F. in circuits 3 and 4. Since in these circuits capacity reactance also balances inductive reactance and there is no single unit (coil, condenser, spark-gap, etc.) across which it is possible to put a voltmeter so as to get a low reading, we are forced to say that for *freely oscillating circuits of any frequency, audio or radio, for which the conditions of resonance hold whereby the capacity and inductive reactances balance each other, the*

*power factor is zero or nearly zero.* In this last statement I would beg leave to differ with the Board appointed at the Chicago Convention to consider the telegram of the Bureau of Standards (QST, October 1921).\*

One is apt to gather from the above discussion that for circuits of audio frequency the power factor is unity while for circuits of radio frequency the power factor is zero but that would be a mistake. Rather the crux of the situation is this: if a circuit of whatever frequency has an external E.M.F. or its equivalent impressed upon it then the power factor will be high for the voltmeter reading across this impressed E.M.F. will be low on closed circuit; but a freely oscillating circuit of whatever frequency will have a low power factor, for there is no external E.M.F. and hence there is nothing in the circuit (but ohmic drop of potential) across which a voltmeter may be placed so as to give a low reading.

It is hoped that the above discussion will prove of value to some of the readers of this journal and that Mr. Stone and Mr. West will each get what comfort he can from it.

\*It must be such circuits that Professor Morecroft has in mind when he says in his text book on radio communication "in some parts of efficient radio circuits the power factor may be as small as 0.005."

## Daylight Transcons

By F. H. Schnell, Traffic Manager

**S**UNDAY July 2nd, Tuesday July 4th, and Sunday July 9th, will mark the first attempts by members of the A.R. R.L. to push a message from Coast to Coast between the hours of 9 a.m. and 6 p.m.

We are optimistic and do not anticipate electrical storms, but three days were selected to overcome such disturbances as would prevent our working.

Hardly can it be expected that each message will go through to its destination, but we want to see just how far we can reach by amateur radio in daylight.

Several reasons for attempting daylight relays prompt this severe test for us amateurs. QRN and QSS are practically nil during the day and should not cause any trouble. The increased number of stations makes for short jumps within the normal limits of the range of transmitters. Daylight routes are in operation in many parts of the country. So why not, fellows? What is there to prevent daylight "Transcons?" Let's try it!

Here is an opportunity to see what your outfit will do in daylight, whether it be

spark or C.W. There is plenty of room for everybody to participate in the affair and here's how it will start.

Promptly at 9 A.M. Pacific Standard Time, on each of the above dates, a station in California will start an eastbound message addressed to our President, Hiram Percy Maxim, 1AW, while at 9 A.M. Eastern Standard Time a station in Maine will start a westbound message addressed to a station in California. Each of the messages on each day will go via our three routes, Northern, Central and Southern—against time. The idea is to put the eastbound message as far EAST as we can and the westbound message as far WEST as we can during the hours of the tests.

All transmission will stop at 6 P.M. your local standard time.

It is of vital importance that you keep an accurate log designating your local standard time, with call letters of stations from which you received the message and to which you transmitted the message. Without an accurate log from each station it will be impossible to determine just where each message stopped at 6 P.M.—

be sure and keep a log, and immediately after each test send a copy of your log to the Traffic Manager, A.R.R.L. 1045 Main St., Hartford, Conn.

Remember the dates—July 2—4—9th.

Stick to your guns, men, and let's write another page into the history of Amateur Radio.

## 1QP-An Interesting C.W. Transmitter

**J**OHAN L. REINARTZ of 1QP, originator of the justly famous "Reinartz tuner" for the reception of C.W. telegraph signals, has now produced a transmitter at his station that makes use of much the same principles as the receiver and is quite as novel.

1QP's set is a panel using four U.V.202 Radiotrons with 700 volts of rectified but unfiltered A.C. on the anodes, antenna currents up to  $3\frac{1}{2}$  amperes being obtained. Photographs with this article show front and rear views of the panel, about which there is nothing particularly unusual except the two spider-web coils, one at either end of the main inductance.

This brings us to the wiring diagram, Fig. 1.  $L_1$ , the main tuning inductance, is a helix of  $8'' \times \frac{1}{2}''$  edgewise-wound copper strip.  $L_2$  and  $L_3$  are the spiderwebs, respectively in the plate and grid circuits, both wound of No. 24 D.C.C. wire on  $2\frac{1}{2}''$  centers.  $L_3$  has a total of 75 turns, tapped

able plates to ground.  $C_1$  is operated at very low values of capacity but must be variable. The grid leak  $R$  has a resistance of 10,000 ohms and the same value is used for any number of tubes from one to four, correction apparently being got by adjusting the value of  $C_1$ .

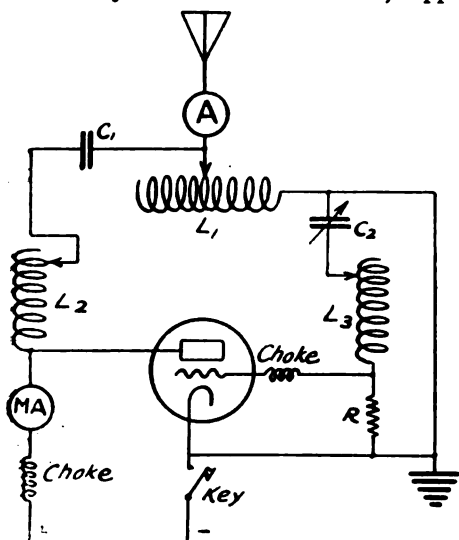
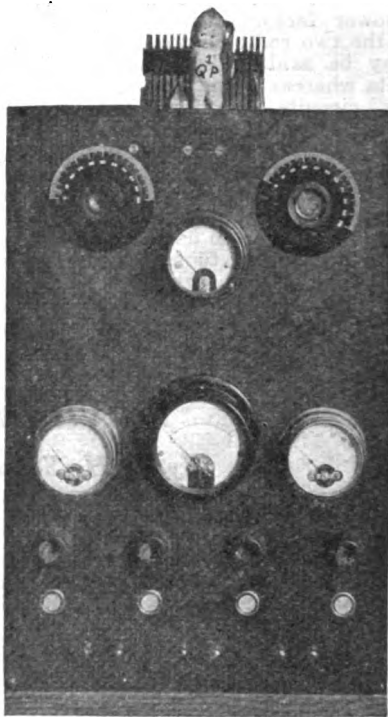


FIG. 1

every 15 turns, while  $L_1$  has ten taps of 5 turns each.  $C_1$  is a fixed mica condenser, high-voltage type, capacity .002 mfd. or thereabouts, while  $C_2$ , the grid condenser, is an air variable of 7 plates widely spaced to stand the voltage, built up from a 13 plate of ordinary construction, with mov-

It will be remembered that in the Reinartz receiving tuner the aerial circuit is untuned and shocks the tuned secondary circuit into oscillation at the latter's period, reducing tuning to one control. (Because of the loose coupling afforded by the fact that the aerial circuit consists of but a turn or two of the coil, the tuning is much sharper than in the usual single-circuit tuner.) Rather naturally, the transmitter observes the reverse of the receiver performance—over a considerable band of wave lengths the grid and plate circuits operate aperiodically and the radiated wave length is determined solely by the position of the antenna clip on  $L_1$ . Thus 1QP has a wave length of 174 meters when



but one turn of aerial inductance is used, climbing to 212 when 6 turns are used, and the antenna current remains constant regardless of the shortness of wave.

It is a little puzzling to trace out the theory of the thing from Fig. 1, so let us turn to "A" in Fig. 2, which shows the same thing. Immediately we recognize the circuit recommended by 1QP for his receiving tuners, except that the location of the grid condenser has been changed. Compare this with "B", which is the

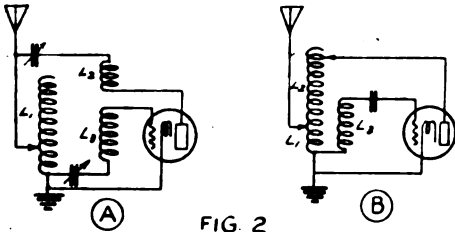
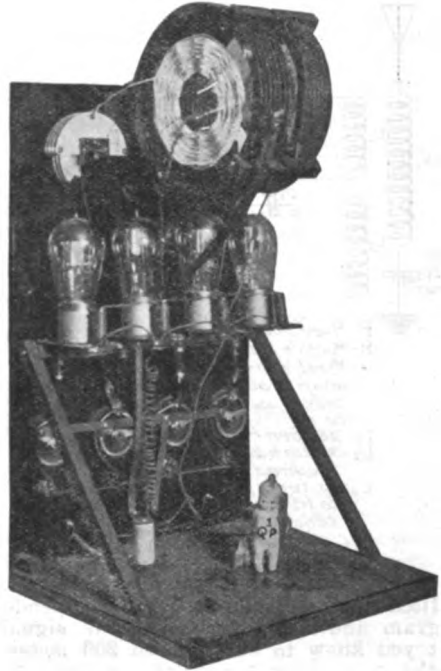


FIG. 2

popular "1DH-9XI-Stanley-British-Aircraft-G.E.-reversed-feedback" circuit giving such excellent results in many amateur stations.  $L_1$  and  $L_2$  are the same and the only difference is that where "B" uses the unused turns of the main helix for the inductance  $L_2$ , circuit "A" uses a separate winding  $L_2$ . It is quite permissible to have this inductance separate; it is a reactance for the adjustment of the output impedance of the tube and does not even have to be coupled to  $L_1$ . In fact in the Reinartz set neither  $L_1$  nor  $L_2$  need to be coupled to the main helix and are placed at the ends of the winding merely because it was convenient structurally to stick them there. When so coupled, however, the polarity is important of course—in one direction they work well and in the other they don't. Fig. 1 shows no coupling between them.

The set is easy to adjust. The antenna clip determines the wave length. Grid circuit C,  $L_1$  must be set approximately right by selecting the proper tap on  $L_1$  and

getting final adjustment by securing the best value of  $C_1$ . As in any such circuit, preliminary adjustments are made using all of the inductance of  $L_1$  gradually cutting it down as the efficiency is improved. If the anode voltage is variable it too should be reduced while first adjustments are being



made. As the adjustments proceed increased efficiency will be apparent mainly by a reduction of the input to the tube—a reduction that drops it below the normal safe rating—whereupon the voltage is increased to bring the input up to normal, the output increasing proportionately, with about the same efficiency as before.

1QP's transmittor circuit works F.B.

—K.B.W.

## A Weagant Circuit Receiver

By F. A. Hill, 4GL

**I** YIELD me to a thousand demands that I write a description of the receiver at 4GL. The circuit is as old as the hills—see Bucher's "Vacuum Tubes in Wireless Communication"—and credit for the hook-up belongs to Roy A. Weagant, engineer for the Radio Corporation of America.

Referring to the accompanying diagram, which should be self-explanatory, this is a set built around a receiving tube. If you use "J" tubes, for instance, your tickler circuit  $L_1$ ,  $C_1$  will be of different proportions than for a U.V.200. The set can be made

to work on both but best results at 4GL have been obtained by building the circuits to suit a "J" (VT-1) tube. It takes a little patience to get it working right at first. Don't hook it up in a hurry and expect to hear a Ford coil in Honolulu the first night; or write to QST and say it's no good. Save your comments and turn them into inquisitiveness directed at the set itself.

$L_2$ , the secondary, is made from a 35-turn honeycomb coil with turns pulled off to get exactly the right inductance. The tickler,  $L_1$ , is wound of No. 36 S.C.C. wire on a card-



## The Radio Telephony Conference

THE conference called by Secretary Hoover to consider the general questions concerning the regulation of radio communication with particular reference to problems involved in the broadcasting of news and entertainment was brought to a satisfactory conclusion on April 19. All suggestions received were given very careful consideration, and the great majority of comments approved the recommendations of the preliminary report which was issued early in March, and as a result the final report, as amended and adopted, was released on April 29.

This report makes recommendations as to the allocation of waves for particular kinds of radio telephone service. It is expected that at an early date a bill will be introduced in Congress which, if passed, will establish the recommendations of the conference as the general law to govern the operation of radio.

### Some of the Recommendations

Some of the more important provisions of the Conference's recommendations are as follows:

That waves for radio telephony be assigned in bands, according to the class of service; that within these service bands a particular wave length be assigned each broadcasting station; that the amateur band be sub-divided into bands according to the method of transmission, sparks on the lowest wave lengths, I.C.W. and M.C.W.

next, then phones, then straight C.W. telegraphy, with broadcasting permitted within the amateur phone band; that the present regulations respecting experiment stations remain in effect; that direct advertising by radio be absolutely prohibited; that the power of broadcasting stations be limited and specified in order that as many services as possible may be permitted; that in order to prevent jamming between broadcasting stations the same wave length not be duplicated within a radius of approximately three times the normal day range of any such station; that where broadcasting congestion exists, hours of operation be specified for the broadcasting stations; that when all available wave frequencies in any geographical region are already assigned, no further broadcasting licenses be granted in that region; that the amateur's status and his wave lengths be defined in the new law; that amateur deputy inspectors be authorized.

While the Conference was in recess many comments were received from all over the country and upon reconvening it was found desirable by the Conference to make changes in the recommended allocation of wave bands as originally proposed. The changes for the most part take the form of opening the public band and the private band each to the other in most cases, and in the establishment of additional bands for the use of both of these services. The recommendations are given in the following table:

| Use  | Wave Length<br>Meters |
|--|-----------------------|
| (1) Transoceanic radio telephone experiments, non-exclusive. (See Note 3) .....              | 6,000 to 5,000        |
| (2) Fixed service radio telephony, non-exclusive. (See Note 4)....                           | 3,300 to 2,850        |
| (3) Mobile service radio telephony, non-exclusive.....                                       | 2,650 to 2,500        |
| (4) Government broadcasting, non-exclusive. (See Note 1).....                                | 2,050 to 1,850        |
| (5) Fixed station radio telephony, non-exclusive. (See Note 5)....                           | 1,850 to 1,550        |
| (6) Aircraft radio telephony and telegraphy, exclusive.....                                  | 1,550 to 1,500        |
| (7) Government and public broadcasting, non-exclusive.....                                   | 1,500 to 1,050        |
| (8) Radio beacons, exclusive (See Note 6).....   | 1,050 to 950          |
| (9) Aircraft radio telephony and telegraphy, exclusive.....                                  | 950 to 850            |
| (10) Radio compass service, exclusive. (See Note 7).....                                     | 850 to 750            |
| (11) Government and public broadcasting, 200 miles or more from the seacoast, exclusive..... | 750 to 700            |
| (12) Government and public broadcasting, 400 miles or more from the seacoast, exclusive..... | 700 to 650            |
| (13) Marine radio telephony, non-exclusive. (See Note 8).....                                | 750 to 650            |
| (14) Aircraft radio telephony and telegraphy, exclusive. (See Note 8)                        | 525 to 500            |
| (15) Government and public broadcasting, exclusive.....                                      | 495 to 485            |
| (16) Private and toll broadcasting. (See Note 9).....  | 485 to 285            |
| (17) Restricted special amateur radio telegraphy, non-exclusive. (See Note 10).....          | 310                   |
| (18) City and state public safety broadcasting, exclusive. (See Note 11) .....               | 285 to 275            |
| (19) Technical and training schools (shared with amateur). (See Note 12) .....               | 275 to 200            |



Note 14. The Conference is of the opinion that broadcast transmitting stations should not in coastal regions be permitted on wave lengths closely adjacent to those assigned in the marine traffic and believe that its recommendations provide for adequate protection of such marine traffic. The Conference recommends the assignment of wave lengths adjacent to those used in the marine traffic to inland stations under such conditions as to avoid interference with the marine traffic.

#### New Bill Soon

The legal section of the Department of Commerce at this writing is engaged in drawing up an *amendment* to the present radio bill, which will no longer make it obligatory upon the Secretary of Commerce

to issue licenses upon application but will give him wide discretionary powers and permit the administration of radio in accordance with the Conference recommendations. The A.R.R.L. reserves opinion on the new bill until its actual appearance.

We hope there will be no undue delay in putting the new bill into law, but we are afraid there will be quite a fight in Congress when it appears. There are some individuals and some interests who are out gunning for trusts and folks that like a good lively scrap are pretty likely to find it in Washington when the new bill comes up. —K.B.W.

## Greater "DX"

By F. H. Schnell, Traffic Manager

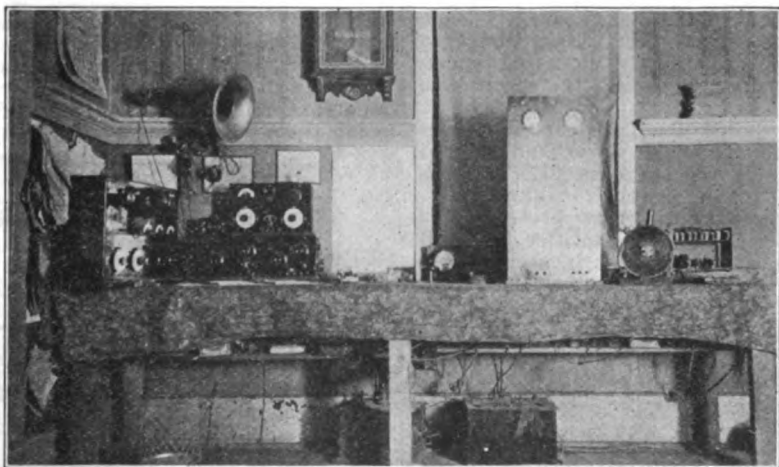
**W**HAT is it that makes an amateur buy pounds and pounds of wire for a good ground connection, stick up poles as high as he can get them and do hundreds of other seemingly unnecessary things about his station?

Distance—greater "DX" traffic handling—that's the answer! That is the prime factor in an amateur's life. He wants to annihilate miles.

Handling traffic on schedule is a method of increasing the distance over which traffic is handled.

has been termed by many, to do this, which has been proved by the fact that 6ZZ, H. L. Gooding, of Douglas, Arizona, was copied by four Hartford, (Conn.) amateurs four mornings in succession for one hour each morning.

Having no idea of the transmitting equipment at 6ZZ except that it was CW (can't seem to lay off that CW) did not deter us from our idea. A night letter was sent to 6ZZ and 6ZF asking them to transmit for one hour, three to four A.M. Eastern Standard Time, beginning April 8th, and continuing through April 12th.



Station 6ZZ, Douglas, Ariz.

Bearing in mind some unusual distances over which sufficiently powered stations have been heard, the idea occurred that stations on the Pacific Coast could be heard on the Atlantic Coast providing a schedule of listening periods was adopted and type of transmitter and exact wave length was known to the listeners. Now it does not take a super-station, as 1BCG

6ZZ was asked to advise the wave length he would use, and which we found was about 365 meters.

The alarm clock did not disturb the operator at 1MO for the first morning's test, but fortunately nothing was lost as 6ZZ got his dates mixed and did not transmit. On the morning of the ninth and tenth signals were quite steady and

could be copied with the detector alone, while with two steps of audio frequency amplification signals were audible fifty to sixty feet from the phones. Upon examination of the logs of Hartford amateurs, 1BHW, operated by our editor K. B. Warner, was the first station to log 6ZZ, the time being 3:01 A.M. At 1MO, 6ZZ was logged at 3:08 A.M. This was April 9th. Radiations set up by the various receiving tuners caused some interference. Static was moderately heavy during this period, but 6ZZ was heard until 3:55 A.M. when he stopped transmitting.

The success of hearing 6ZZ brought out more receivers and the morning of April 10th found perhaps three more ops on the job, but with all the squealing and beating of receivers it sounded like dozens. In spite of this handicap four amateur stations logged 6ZZ for a solid hour. Messages were sent and about sixty percent of them were copied through interference.

Having noticed the slight increase in signal strength as daylight broke on the tenth, we popped a wire to 6ZZ and asked him to transmit from four A.M. to five A.M. on April 11th. Nope, not for the purpose of fooling the other listeners, O.M. They were there to stick from 3 A.M. till sunup. The morning of April 11th greeted us with moderate static and it sounded like every receiver in Hartford was feverishly combing the ether for 6ZZ, who started calling 1MO at 3:59. This brought a lull in the tuning as apparently each receiver was hearing 6ZZ. Four messages were copied and signals increased amazingly after daylight, while the static was almost nil.

Evidently other Pacific Coast amateurs were getting the "DX" fever and wanted to horn in on the tests as 6EN at Los Angeles logged by 1BHW, calling 1AW.

An amateur takes great pride in his equipment, especially his rectifier, and will go to any means to protect it, as is shown in one of the messages copied from 6ZZ which read as follows:

Corona Typewriter Co.,  
Groton, N. Y.

Was Corona worth fixing? Threw it at my dog when he caught his tail in rectifier.

H. L. Gooding.

The increase in signal strength which occurred after daylight prompted a wire to 6ZZ asking him to transmit from five A.M. to six A.M. on the morning of April 12th. We also asked him to listen for 1BGF (1 fifty-watt tube) from three to four A.M. 6ZZ reported hearing 1BGF at 3:40 a.m. but unreadable through heavy static.

At five A.M. on the morning of April 12th it was broad daylight and signals from 6ZZ were unusually QSA. Every-

thing was copied until the sun came over the hill at 5:27 when 6ZZ faded out completely, thereby ending one of the thrills we enjoy now and then.

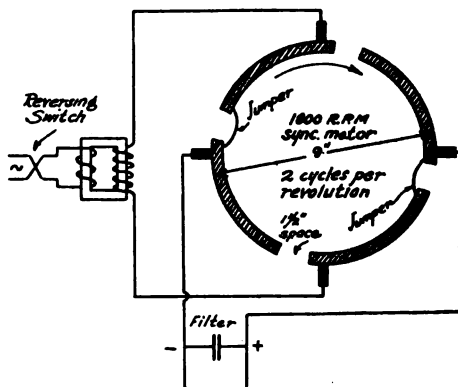
### The Receivers

- 1BGF—Three circuit regenerative, detector only, antenna 4 wires 60' high, 60' long.
- 1BHW—Reinartz single circuit, 2 steps, antenna 1 wire 100' long, 20' high.
- 1HX—(Boyd Phelps, formerly of 9ZT) antenna 40' high, 225' long, single circuit, 2 steps.
- 1MO—Three circuit regenerative—2 steps, antenna 1 wire 135' long, 24' high.

The CW transmitter at 6ZZ uses two 50-watt-tubes on a synchronous rectifier with 1000 volts on the plates, space current 210 M.A. On a wave length of 365 meters the antenna current is 7.5 amps. A spark set, which has not been used recently but which is always ready for action, consists of a 1 K.W. Thordarson transformer; .007 M.F. condenser made of  $\frac{1}{4}$ " glass in oil built according to 9ZN's article in QST; Hyrad non-sink gap; and pancake O.T. The antenna current at 200 meters is 4.5 amps.

The antenna at 6ZZ is of the inverted L type with an 8-wire cage, 60 feet long and 60 feet high. The counterpoise is 165 feet long and 15 feet above ground. Receiving equipment comprises a "Reinartz" tuner, short wave regenerative receiver, and four steps of A F. amplification.

Editor's Note—The high-voltage synchronous rectifier finds a new role in amateur C.W. operation. Altho almost unknown in the eastern states many west coast amateurs, notably 6ZZ, 6JD, and 6EN, are using them with good results.



The sketch illustrates 6ZZ's layout, which consists of a 9-inch bakelite disk  $\frac{1}{2}$ " thick carrying four copper segments and driven at 1800 r.p.m. by a synchronous motor. The four brushes are regular medium hard carbon motor brushes,  $\frac{1}{8}$ " thick x  $\frac{1}{2}$ " wide, set in holders and capable of revolution to adjust to synchronism. Two brushes feed

the high-voltage A.C. to the disc and the other two convey the rectified current to the filter system. In other words, it's a rotary reversing switch, operated synchronously.

Mr. Gooding says it runs without a hitch but the primary requirement is that it be a first-class machine job, run perfectly true, etc.

## Amateur Storm Relief Work

By R. H. G. Mathews, Central Division Manager

ON the morning of February 21st the entire Fox River Valley in the northeastern part of Wisconsin was visited by a heavy rain storm continuing during the entire day and the greater part of the following night. During the night the temperature suddenly dropped to freezing, giving the entire district affected a complete coat of ice. The rain continued and froze as it fell, until trees, poles, wires and everything in general was covered with from four to six inches of heavy ice. About 4:00 A.M. on the morning of the 22nd the temperature dropped still farther, which was followed by heavy snow flurries.

About this time electric wires went down, train service was brought to a standstill, and the entire telephone, telegraph, and power and lighting service of all the cities in the Fox River Valley was cut off. As Quinn of 9ZL put it "The only means of communication and transportation was by foot, with very poor footing at that". The next act of the storm was to bring still colder weather and high winds, which carried away telephone poles, wires and trees, eliminating the possibility of repairs.

At about eight o'clock on the morning of the 22nd one of the large paper manufacturers at Neenah, Wisconsin, went to Quinn Brothers, who have just taken over 9ZL's old special license, and asked them if there was any possible way to get a message through to Manitowoc in order to obtain coal to keep the mills running. Upon the explanation being given that they were without power due to the failure of the city lighting service, he informed them that the mills could supply their own alternating current from their power plant, and suggested the installation of a radio set at the mill.

After some discussion and the ransacking of all the stations in Neenah the Quinn

brothers, together with Mr. Bishop of 9DV, scraped together a  $\frac{1}{2}$  k.w. spark transmitter and a regenerative receiver with detector and two-step amplifier. Although 9ZL's regular equipment consists of CW apparatus, in emergency the old reliable spark came into its own. As Mr. C. J. Quinn poetically puts it,

*"Ashes to ashes or dust to dust,*

*The CW will work 'em*

*But in sparks we trust*

*We'll raise that ham with a spark or bust."*

Within six hours the three of them had the set in operation which is shown on the enclosed photo, the three operators shown



being the two Quinns and Mr. Bishop. The set was tuned to 600 meters and communication immediately effected with the station of the Pere Marquette Railroad, WMW, located at Manitowoc, Wisconsin. In this connection it is interesting to note that the call of the Neenah emergency station, which was signing 9ZL, was not heard by WMW until one of the operators of the Manitowoc station who is an amateur and was listening on a 20 foot indoor aerial phoned the commercial station and informed them that they were being called.

9ZL had hardly cleared their emergency



traffic with WMW when 9DHG at Oshkosh called with a lot of traffic from his city which he reported to be in the same condition as Neenah. 9DHG had of course lost his aerial when the rest of the wires went down and his power was also disconnected. In order to overcome this difficulty he had put together a spark coil outfit and was working with a temporary aerial strung up in his attic. As the day went on other stations came in using temporary apparatus, for the most part spark coils. Among these were Lawrence College at Appleton, Wis., and Emmet Platten of Green Bay, Wisc. Many extremely important messages were handled and invaluable service rendered, particularly to the Northwestern Railroad Company, which had had several wrecks and was in great need of

wrecking equipment. By radio this was secured and rushed to the scenes of the various accidents.

The condition outlined above obtained for a week in which time 9ZL handled 250 messages. A steady watch was kept at all times by the two Quinn Brothers and Mr. H. Bishop, all three of whom are ex-commercial operators. The messages handled related only of matters of extreme importance such as railroad messages, death messages and supply orders for the stricken districts.

By their work the amateurs of Wisconsin have engraved for themselves a place in the Radio Hall of Fame and have rendered to amateur radio in general a service which will not soon be forgotten.

## A Symposium on Aluminum Electrolytic Rectifier Operation

Edited by S. Kruse

In these days of the onrushing C.W. the question of a cheap source of plate energy for vacuum tube transmission is a vital one. Electrolytic rectifiers have offered great promise but no reliable information suitable for amateur purposes has heretofore been available. The few cases where they worked satisfactorily seem to have happened accidentally. Literature of the art confined itself to commercial applications of the rectifier—wholly valueless to us amateurs. So we have gone out and got the information. The A. R. R. L. Operating Department and our Affiliated Clubs, under the guidance of our Traffic Manager, unearthed the data among their successfully operating stations and Mr. Kruse compiled and analyzed it. Here, then, is reliable, practical, tested dope upon which reliance can be placed.

QST feels that it is putting forth a distinct contribution to amateur literature in presenting this symposium, and our cordial thanks are extended Mr. Kruse and the Operating Department members and Clubs whose co-operation made it possible.—Editor.

### Contributors

This paper is compiled from information supplied us by the following A.R.R.L. members:

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### The Good Electrolytic Rectifier

This paper was inspired by the discovery that many of our members are using very inferior electrolytic rectifiers for plate power supply without being aware what very poor performance they are securing. It is well therefore, to start by defining the performance of a good rectifier.

A good electrolytic rectifier of the alumi-

num type operates entirely without fire-works on the plates, without any noticeable heating, and it is possible to apply the full transformer voltage to it without any appreciable input until the filaments of the tubes are lighted. In other words the rectifier alone, put across the transformer, takes no power.

A rectifier that does not pass these tests is badly at fault and needs rebuilding at once.

### The Number of Jars Needed

Someone was at one time guilty of passing out the misinformation that a rectifier jar will take care of something like 125 volts. This is absolutely wrong if ordinary aluminum is used and as yet we have no experimental proof that it is correct with any grade of aluminum. All the men who have rectifiers that have been shown by measurement to be performing finely, rectifiers that will pass the tests given above, are using one jar for every 40 or 50 volts.

The use of enough jars is the most important single item in rectifier construction. Jars must be added until scintillating, sparkling fire no longer appears on the plates but only a faint blue glow—a sort



phosphorescence—is left. All other precautions can then be observed but the main one has been taken care of. If you are lucky enough to have pure aluminum available, you may be able to use fewer jars, but the general rule remains—add jars until only the faintest blue or greenish phosphorescence is seen.

#### The Current Density

The current density governs the amount of heating which will occur in the cell. Small aluminum electrodes will heat rapidly and require water cooling of the jars or else the use of very large jars. Large electrodes will not heat, even though the jar is very small. As electricity at ten cents per kilowatt hour is an expensive thing with which to heat water, the large plates are thoroughly worth while. 100 milliamperes per square inch is too much, but will do for short period operation. For the continuous work of a relay station or a phone set, this is entirely too high and a square inch should be allowed for each 40 millamperes.

#### Solutions

No rectifier works properly and continuously if well or cistern water is used; distilled water is just as necessary as for storage batteries. There follow solutions which appear to give not widely different results.

- (a) Boric acid solution plus slight amount ammonia.
- (b) Sodium borate.
- (c) Ammonium borate 6%.
- (d) Sodium bi-carbonate.
- (e) Boric acid plus ammonia until neutralized.
- (f) Mono-sodium phosphate 10%.
- (g) Sodium phosphate.
- (h) Ammonium phosphate.
- (i) Phosphoric acid 3 ounces to a pint of water. Add ammonia until neutral. Then cool and add more ammonia, using 26% ammonia throughout.

In all solutions, ammonia can be added with benefit. Whatever solution is used, make it up in large quantities and then fill the jars; otherwise they will not operate alike. A large bottle in which some spare solution can be kept is convenient.

The solution evaporates in use and water must be added, otherwise the current density will become too great and heating will begin. The diluted solutions are inconvenient because it is hard to tell how much water shall be added, as part of the electrolyte has crystallized on the glass. With saturated solutions, one only has to refill with water or stock solution and make sure of the strength of the solution by keeping some undissolved crystals at the bottom of each jar.

#### Voltage Per Cell

With very good aluminum and chemically pure solutions, it is possible to operate

with a voltage as high as 200 per cell. This cannot be done with the kind of aluminum ordinarily available, nor can it be approached at all closely. We have yet to see the first rectifier employing a voltage as high as 80 per cell which was not showing either excessive heating, which means low efficiency, or else destructive sparking, which also represents bad efficiency. With ordinary materials the voltage per jar must not exceed 50. This means that if 400 volts are to be rectified with a center tap transformer, there will be required 20 jars, 10 on a side, giving 40 volts per jar. If we are rectifying 1000 volts, 50 jars will be required. The importance of this can be seen by measurements made on an actual rectifier at 3ZY. When a 20-jar rectifier (10 jars on a side) was operated at 400 volts, the input to the rectifier with no tubes connected was 10 watts and there was absolutely no heating after two hours operation. Nor was there anything to be seen at the aluminum plates except a faint greenish glow. When 1000 volts, which is 100 volts per jar, was applied, this same rectifier drew 485 watts, warmed up very nicely in ten minutes, and gave a very fair small-sized Independence Day celebration. The present rectifier at 3ZY is a 48-jar affair operated at 1000 volts and drawing 15 watts on no load. This is a performance that some of our correspondents will go a long ways to equal. This rectifier, by the way, operates two or three hours every evening with no perceptible heating, although supplying about 200 watts to the UV-203 tubes.

#### Efficiency

No real good information on efficiency is available but it is of no great importance, as a rectifier which operates continuously and without heating is undoubtedly operating at good efficiency.

#### Temperature of Operation

There is an insistent tendency to quote an operating temperature. Judging by the information gained in this symposium, the proper operating temperature is room temperature. In other words, there should not be any heating of the rectifier and consequently no rise in temperature.

#### Life of the Solution

The frequency with which the rectifier solution must be renewed depends on the amount of use it gets and the purity of the electrodes. The best aluminum is not good enough and commercial aluminum is far from being good enough. There is also considerable variation between pieces of aluminum from the same sheet. Hence jars in the same series will not act alike. It may accordingly be necessary to clean up some jars before others and no definite time of operation can be given.

#### Life of Plates

The life of the plates, if they are reason-

ably pure, depends entirely upon the amount of electrolysis which they undergo. This assumes that they are not required to act as electrodes for a pyrotechnic display, in which case they will go very fast. Impure plates also do not last long since the impurities consisting chiefly of carbon and aluminum compounds remain as projections while the aluminum wears down between them, which shortly ruins the plate, making a carbon or iron plate out of an aluminum one, and causes the rectifier to cease operating. Such plates may be detected by their appearance and uneven operation, as they never glow uniformly over the entire surface.

#### Forming

With the phosphoric acid solution it is possible to set up a new cell and put it into use at once, as forming is almost instantaneous. With all the other solutions, gradual forming is necessary and a satisfactory job cannot be done with the cells in series. The proper way to do the thing is to place all cells in parallel and connect them to a source of direct current having a voltage of 100 to 200 with a 32 candle power lamp in series. All aluminum plates that intend to form will begin within ten seconds and be done in sixty seconds. Those that do not intend to form may be dirty on the surface and can be cleaned by caustic soda or caustic potash and tried again after careful washing. If no direct current is available, forming on low voltage a.c. can be tried but is not especially satisfactory, and the only remaining thing is to connect the cells in the way that they are to work later on and raise the voltage gradually. The rectifier can very easily be ruined by careless forming. The full trans-

former voltage must not be applied at once but gradually, remaining at each voltage until the input to the rectifier has dropped to practically zero. If at any time during the process the rectifier starts to heat, operations must be suspended until it has become perfectly cool again. Forming is not permanent as the coating dissolves off when the rectifier is not used for a time, hence long periods of rest must be followed by renewed formation.

#### Sealing the Cells

It is not generally very satisfactory to seal rectifier cells as they have to be cleaned periodically and the job of cleaning up fifty jars which contain aluminum, lead, water and oil, is an exceedingly messy one. The aluminum electrodes, however, tend to heat and corrode at the surface of the liquid and it is desirable to insulate them through this surface. This can be done with a coating of asphaltum but never with complete satisfaction, as the stuff tends to go into solution and a better material should be discovered. Paraffin will do if the cell can be kept quite cool but in summer weather is likely to let go and come to the surface of the cell. If an oil seal is used a white petroleum oil or grease, such as Squibb's petrolatum or albolene, will be found useful.

#### Spacing and Shape of Electrodes

The electrodes should be parallel and should not be too close to the sides of the jar, especially at the surface, as boiling will occur at that point if the jar is too near. Quite a few rectifiers are operating with a lead electrode larger than the aluminum one but their performance does not seem to be spectacularly different in consequence.



A new world's speed record established at the Boston Show. Joseph Seron's record in code copying, made at the last Second District Amateur Show, was short-lived, for here is Theodore R. McElroy of Somerville, Mass., new champion, being presented a cup by the show manager, after having received 51½ words per minute.

### Purity of Electrodes

There is no very good test of the purity of the aluminum. Experience seems to indicate that cast aluminum is somewhat more satisfactory in operation, especially if the slabs are from a cast block. Cast aluminum usually contains zinc but is less likely to contain carbon and aluminum oxides than is low-grade sheet rolled from aluminum junk.

The only real test is to try the particular piece of aluminum and see how it acts. If it fails to produce the proper even performance at the working voltage, it must be thrown out and with it the solution in which it has been used. If the solution is not changed a new plate will also operate badly. A bottom clearance of one or two inches

the firm, altho there are degrees of hardness due to the mechanical treatment the metal receives in rolling. Any aluminum that is purchased from the Aluminum Company of America should accordingly be satisfactory if it is in sheet form.

Cast aluminum is usually adulterated with zinc for the double reason that better castings are secured and that the foundry (which gets paid by the pound) gets more money for the same number of pieces. Impure sheet aluminum is also on the market. It is made from remelted material. It was originally pure but now contains copper, iron, zinc and very commonly a good deal of carbon.

The general effect of the above is that any aluminum which was certainly pur-

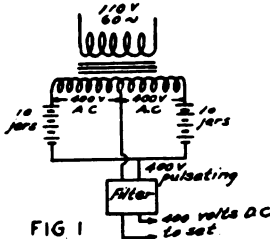


FIG. 1

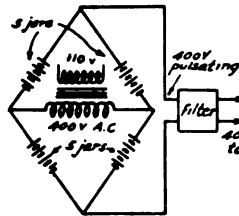


FIG. 2

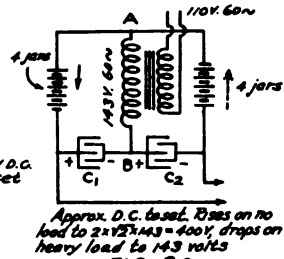


FIG. 3a

underneath the electrodes will aid if poor aluminum is used as the resulting precipitates can accumulate for some time before doing much damage.

### Sources of Aluminum

Sheet aluminum may be obtained from the Aluminum Company of America but no information has been forthcoming as to the grades, prices, or commercial forms. Eimer and Amand, 240 West 42nd St., New York City, supply electrolytic rectifier plates which have been formed in advance. Old aluminum arrester cones are good as the material has been chosen for a similar purpose. Aluminum rod may be obtained in the form used in electric and oxyacetylene welding. These rods are 36" x 1/4" and seem to be satisfactorily pure. Castings have been mentioned before and if they are made to order, care should be taken that the foundry does not add excessive zinc. Zinc is necessary to secure a clean casting but foundries have a pleasant habit of selling castings by the pound, which induces them to add zinc or something of that sort to weight up an aluminum casting.

The aluminum sold in the United States and Canada is that prepared by the Aluminum Company of America and its Canadian associate company or else is remelted and adulterated aluminum which was originally of the same origin. The process by which the aluminum is originally prepared is electrolytic and the metal is quite pure. It is obtainable in only this one degree of purity, according to the Boston agency of

chased from the Aluminum Co. of America will be satisfactory.

### Cleaning the Jars

When a cell has run for some time, a milky precipitate appears at the bottom. If the cell is deep, this will not reach the plates for some time. When the plates are reached, the cell should be cleaned up. The plates are laid aside while the jars are being emptied and scrubbed. If all the plates have been working perfectly, they should not be scratched or handled. If some are bad, they should be replaced and the rest used again, but if most of the cells are dead, it is necessary to clean up all the plates with lye and a coarse brush, then wash in water and reassemble with fresh solution.

### Volume of Liquid

A large volume of liquid is not necessary if the voltage per cell and the size of plate are correctly chosen. A good rectifier operates at high efficiency, hence a large volume of electrolyte is not necessary for cooling purposes or to minimize the effect of evaporation. Ordinary jelly glasses may be used for a rectifier supplying two 50-watt tubes at 1200 volts, and if the rectifier is operating properly will after several hours operation have heated so little that one cannot detect any difference by feeling the jars. The generally accepted idea that a pint or quart of solution is needed for such a rectifier or that a water jacket is necessary is based entirely on the performance of inefficient rectifiers.

### Tests of Proper Functioning

Contrary to very general opinion, there must be no fireworks on the aluminum electrode. A very little thought will show that spectacular green sparks on the aluminum represent considerably electrical energy at ten cents per kilowatt hour, not to speak of the great wear on the aluminum electrodes which accompanies such a performance. Fireworks are a definite proof of excessive voltage per cell and the only remedy is to add more jars in series until the scintillating sparks have disappeared and been replaced by a uniform glow having

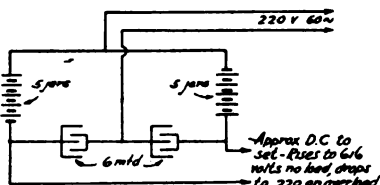


FIG. 3b

With condensers gives about 400v on two "E" tubes

the appearance of phosphorescence. More jars may be added until this disappears also, but it is neither necessary nor desirable. The phosphorescent condition indicates a properly working cell. One that is dark may be working properly but there is no proof.

### Rectifiers for Particular Jobs

A—One 5-watt tube, 350 volts, 40 mils ("E" tube or VT-2). Submerged part of aluminum plates, 1 square inch. Jars required, 20 for center tap or "bridge" connection, 10 for "voltage doubling" connection. (See "Rectifier Circuits".)

B—One 5-watt tube, 1000 volts, 75 mils (U.V.203). Submerged part of aluminum plates, 2 square inches. Jars required, 50 for center tap or bridge connection, 25 for voltage doubling connection.

C—One 50-watt tube, 1000 volts, 100 mils (U.V.203). Submerged part of aluminum plates, 2½ square inches. Jars required, 50 for center tap or bridge connection, 25 for voltage doubling connection.

D—One 50-watt tube, 1500 volts, 200 mils (U.V.203). Submerged part of aluminum plates, 5 square inches. Jars required, 72 for center tap or bridge connection, 36 for voltage doubling connection.

For two or three tubes use same number of jars but double or triple size of plates.

In all cases leave ¾" to 2" clear space under the plates.

For rectifier "A", 1" x 6" test tubes are possible. For rectifiers "B" and "C" jelly glasses are OK; for rectifier "D" jelly glasses or deep drinking glasses.

These rectifiers are very conservative and the size of the plates may be reduced thirty per-cent for intermittent work. The number of jars must not (with commercial aluminum) be much reduced.

### Filters

A rectifier does not turn out direct current when it is operating on single phase supply. It merely turns the alternating current into a pulsating current. That pulsating current is 100 per cent. modulated at the supply frequency; it carries the very heaviest "growl" that can conceivably be put into any supply current and in consequence the tube set will also have a terrific 60-cycle growl on its emitted wave.

It is the job of the filter to receive this pulsating current and smooth it out so that the current which leaves the filter does so at an even rate; in other words, is true direct and continuous current.

There seems to be a general impression amongst the cheaper broadcast stations (which usually use rectified a.c. plate supply) that one only needs to bridge across the rectifier a large condenser and all will be well. This is not exactly true even when the condenser is very large and is very far from true if the condenser is kept to reasonable dimensions. It is, however, possible to construct a cheap and a compact filter without using vast capacities and still secure excellent results. We hope soon to publish a paper on this subject.

### The Rectifier and the Radiophone

A rectifier used for a radiophone should be especially liberally designed and carefully operated. Noises that in themselves are not in the least objectionable are quite ample to ruin delicate shades of tone when music is rendered. These noises may be due to sparkling and boiling of the rectifier or to a defective filter which was not designed but simply put together by guess so that much "60-cycle" comes thru.

An excellent test is to listen to the carrier wave with an oscillating tube when the set is not being spoken or sung into. If the heterodyne note is not perfectly clear, that radiophone has no chance of ever turning out perfect music, regardless of the system or degree of modulation. Not one broadcast station in twenty will pass this test, which in itself is sufficient comment on the offhand way the present broadcast station is operated.

In the case of one Louisiana newspaper broadcasting station the "cooking" of the rectifier is so strong that it can be heard with a crystal at 5 miles and the 60-cycle hum causes all high pitched notes to "burr" strongly. Yet this paper is proud of its phone.

In the case of that station and many others much time, money and effort has been spent and nothing whatever produced that is worthy of respect, simply because there has been overlooked the very obvious precaution of listening to the output of the station in a highly critical mood and then making the needed changes in the rectifier, filter and possibly modulation system.

### Rectifier Circuits

Of the three popular rectifier circuits the split-secondary seems to be in most general use, probably because it is simple and its action is rather obvious. This is shown in Figure 1.

The "bridge" circuit is somewhat less used but has the advantage that it can be operated with a transformer designed for some other purpose and not equipped with a center tap. This circuit is shown in Figure 2.

The "voltage-doubling" circuit has a theoretical advantage in that the output voltage is higher than the input voltage. Referring to Figure 3 the action is as follows: assuming for the moment that the end A of the transformer secondary is positive the current will flow as shown by the solid arrows and the condenser C<sub>1</sub> will be charged as marked. Now when the secondary voltage reverses the end B becomes positive and the condenser C<sub>2</sub> becomes charged as marked, while no current flows into the condenser C<sub>3</sub>. Eventually both C<sub>1</sub> and C<sub>2</sub> will be charged to the peak voltage of the transformer, which is  $\sqrt{2}$  times the secondary voltage. Now note that C<sub>1</sub> and C<sub>2</sub> are in series for the output, so this voltage is doubled. Thus if we started with a secondary having a voltage of 143 we would now have  $2 \times \sqrt{2} \times 143 = 400$  volts. This holds only as long as no load is applied. If we connect a load (some tubes) to the output leads, the condenser

C<sub>3</sub> will be getting discharged while the condenser C<sub>1</sub> is getting charged, and unless the condensers are very large we will drag the voltage down to something like the transformer secondary voltage. In other words the voltage regulation of this sort of set is very poor. That is not necessarily a disadvantage as a sending station using oxide filament (Western Electric) tubes is thus made self protecting.

The voltage doubling circuit is to a certain extent self-filtering as the variations across the two condensers are in opposite phase and so cancel out. It will stand much more critical inspection than many center-tapped rectifiers with alledged filters.

The voltage-doubling circuit has one very pretty possibility. Where 220 volts A.C. is available the voltage-doubling circuit is all that is necessary to supply 400 volts plate for a small radiophone using 5-watt Western Electric "E" tubes (VT-2). This scheme Fig. 3b has been used quite successfully by Mr. J. E. Parker of 3XK. A condenser should be placed in the ground lead to avoid grounding the power line.

### Number of Jars Used with Different Circuits

All three of the figures have been drawn as applying to an output voltage of 400 and the number of jars in each "string" marked alongside. The basis is an allowance of 40 volts per jar. Whether that particular voltage per jar is used or not, the relative number of jars required by the different systems is still the same.

## The Lackawanna Phone Experiments

THE Delaware, Lackawanna & Western Railroad has resumed the experiments we heard quite a bit about before the war in telephoning from moving trains. With the later improvements and under the direction of D. W. Richardson, 3XM, of Princeton, some very interesting results have been secured.

Good signals were obtained with a single wire on one car but better results were had later with three cages  $4\frac{1}{2}$  inches in diameter, of six wires each, and suspended eighteen inches above the roof of the buffet car. A fifteen-watt phone set and a detector and two-step amplifier in conjunction with a regenerative set completed the equipment. Tests were made in late March on the Lackawanna Limited, the station signing "DL"

A very good idea was gained in the matter of what surroundings affect transmission and reception. The tests were made over all kinds of ground and at altitudes from a few feet above the high tide mark to two thousand feet above sea level. Under the steel superstructure of the terminal at Hoboken a few local amateur stations, two

on phone, were picked up but there was a great increase on leaving the shed. Inside the Bergen tunnel, which is 4,283 feet long



Edgar Sisson, Jr., "ES" at 3DH, who with G. D. Murray and D. W. Richardson, all of Princeton University, had charge of the Lackawanna train experiments.

Underwood & Underwood photo. and 90 feet underground, two C.W. stations and several ships were heard dis-

tinctly. On emerging from the tunnel the signals increased with a "bang." Going thru Newark and the Oranges tests were made in transmitting with the phone, which

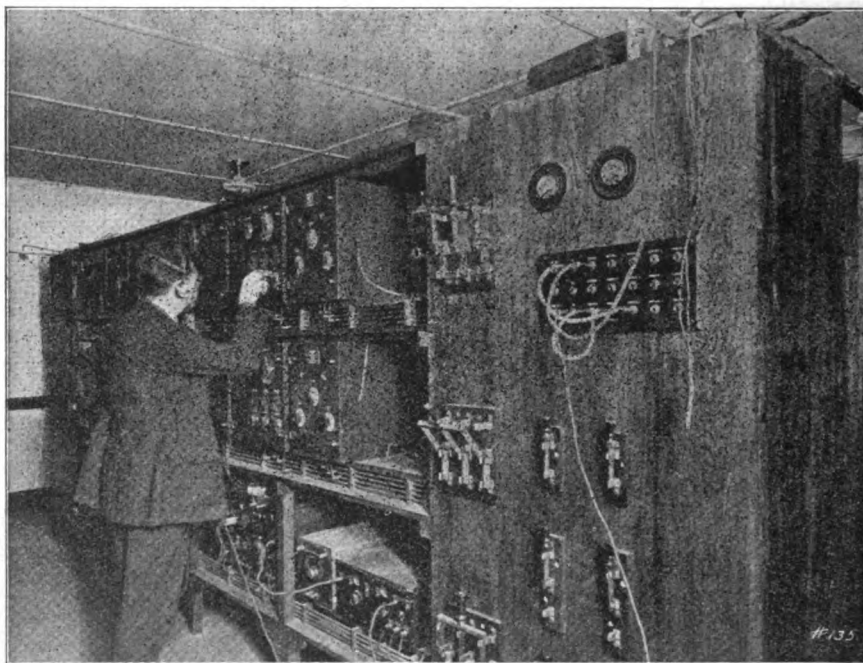
was picked up by several stations. When about ten miles from Scranton, 8ARI was worked while coming down the mountains  
(Continued on page 34)

## Radio Central

*A Paper presented by Pierre Boucheron at meeting of Radio Club of America, Columbia University, January 27, 1922*

**O**UR subject for this evening is to be pictorial rather than technical. I have therefore prepared a short paper based chiefly on the outstanding facts of the big station. I will first read this paper to you and then we shall proceed with the pictorial section. For this we have a number of slides featuring the most prominent sites and apparatus

end entirely. Here we have a huge station built by a commercial concern for a distinctly commercial purpose. My only excuse, therefore, is that the real radio enthusiast, whether an amateur or a professional (and by the way many of us here this evening are professionals) is vitally interested in everything concerning radio. Indeed, one has only to pick up the average radio magazine



Receiving Shelf at Riverhead, L. I.

at Radio Central. We will follow this by a short reel of moving pictures depicting several interesting construction scenes and other incidents connected with the station, followed by some views taken on the official opening day, November 5, 1921.

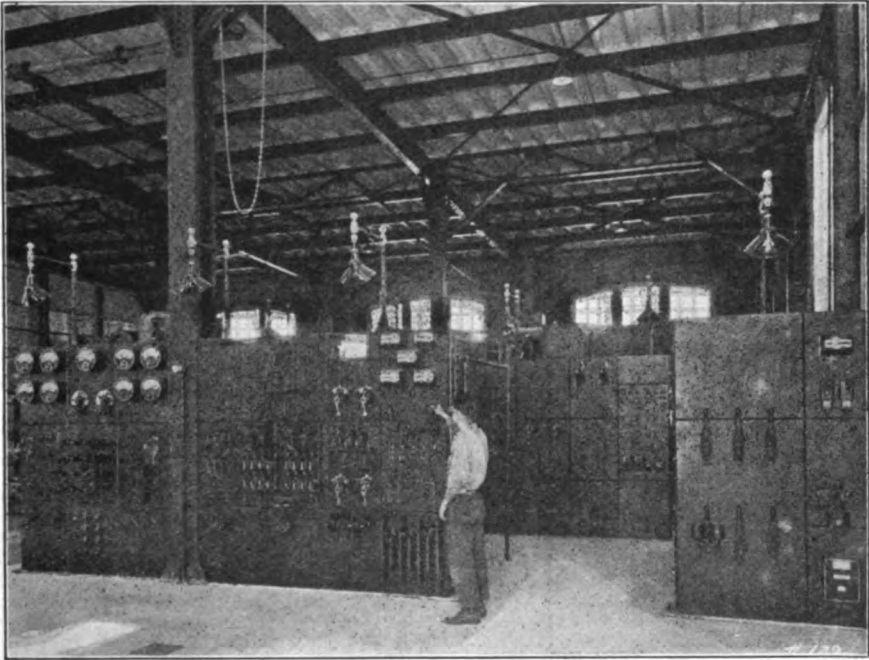
Before we proceed, we shall indulge in a few preliminary remarks. Some of you may wonder why the subject of the evening should be brought up before an amateur organization, for at first thought the activities of Radio Central are essentially commercial ones, and this paper deals with that

and glance through the pages to note the many and frequent descriptions of strictly commercial apparatus or plants originating not only in this country but throughout the world as well. This undoubtedly proves that the average radio amateur is interested in other subjects besides the strictly experimental one.

Then too we have in Radio Central perhaps the greatest radio project in the history of the art. In order that we may bring home the significance and the importance of this latest of American under-

takings, a little history is possibly not out of place here. For many years, England has enjoyed the unique position of being the sole arbiter of the world's communica-

world wide wireless communication. This means that existing radio and cable facilities to such leading commercial nations as Great Britain, France, Norway and Ger-



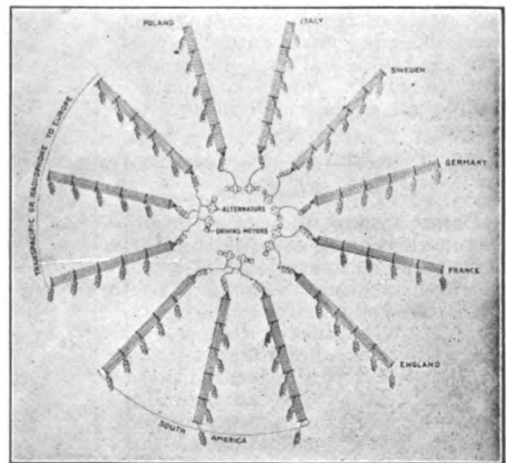
Main Control Switchboard at Radio Central

tion. She has been so to speak the center of communication—cable communication. You have but to look at any communication map to have this fact demonstrated to you in a most conclusive manner. Here you will see the great cables of the world stretching out far and wide to the most remote corners. Incidentally, you will see this giant network of lines merge into one general direction or focal point—that of England. I am not here to tell you that England is to be censored for this. On the contrary, any other nation would have done likewise if placed in the same advantageous position, and it is only natural to expect this. These factors and the fact that the United States has not had adequate means of international communication have not particularly helped us to develop foreign trade. It was quite natural therefore that shortly after the great war, it was decided that if England was the center of cable communication, there was no reason why the United States should not be the center of radio communication. It was thus that Radio Central was conceived—a 100% American owned, controlled and operated wireless central point with facilities for world-wide wireless communication.

With the opening of Radio Central, therefore, New York becomes the focal point of

many are now supplemented by a *direct* radio telegraph service.

Commerce, as we know it today, depends upon complex and highly specialized factors



The Antenna Combination

for success. One of its most important agencies is communication, bringing, as it





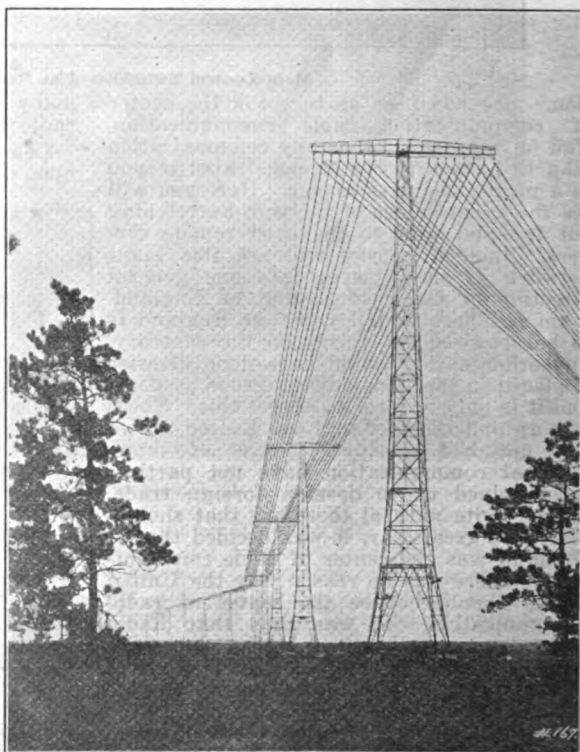
Above: Main Operating Room at New York.  
Below: One leg of the antenna.

does, the marts of the world within easy reach of all. Indeed, without this vehicle world trade would fail utterly. Thus it has come to pass that the art of radio communication has slowly but surely taken its place as a necessary supplement to present cable circuits, and not only is Europe and the Orient covered by the radio system but the new station recently opened has been designed to eventually provide an additional and direct circuit to South America, thereby linking all commercial nations together.

#### Radio Central—Its Purpose and How It Functions

Unlike many industries, radio communication is essentially international in its operation and world wide in its scope. For this reason it has been the dream of communication engineers for several years to erect a huge transmitting station at a centrally located point in such wise as to command a world wide field of activity. Radio Central is the realization of this vision.

In the pioneer days of high power radio telegraphy, a station functioned alternately as a transmitter, a receiver and a telegraph





office. This involved much loss of time and greatly reduced traffic facilities, for a station had to stop sending while it received and vice versa. It, therefore, became apparent that the ideal radio station should comprise three separate but closely connected units operating by remote control and employing a transmitting unit, a receiving unit and a central traffic office, the latter preferably in the heart of the business district of large cities. The Radio Corporation has had this system in operation for some time and having found it most effective has incorporated it in the operation of Radio Central and other trans-Atlantic stations.

The new radio station, therefore, comprises these three units which are:

**RADIO CENTRAL**—A high power multiplex transmitting station located on Long Island some distance from New York City, planned to have several separate antenna systems each designed to communicate with a given country with remote telegraphic control from a point suitable to the handling of traffic.

**RIVERHEAD, L. I.**—A multiplex receiving station also located some distance from New York but separated by sixteen miles from the transmitter and so planned and arranged as to simultaneously receive all radiograms destined to the United States from as many foreign countries as take part in the world wide wireless system.

**CENTRAL TRAFFIC OFFICE, NEW YORK CITY**—The traffic center of the system where all actual radio telegraph operating takes place. Here radiograms are gathered from various sources and directly radioed to foreign points through Radio Central and other high power stations. This direct transmission is accomplished through the use of a special remote control system whereby operators at 64 Broad Street, New York City, do all necessary transmitting work.

In a like manner reception is accomplished with similar direct advantages where the incoming signals are made audible at Riverhead, L. I., and automatically transferred over land-lines to the central traffic office located in the heart of New York's financial district. These signals are interpreted and recorded on typewriters by skilled telegraph operators at highspeed or are automatically received by ink-recorders. Final delivery is then effected through the regular messenger service.

#### Outstanding Facts About Radio Central

Radio Central Station is designed for world-wide wireless communication which includes Europe, South America and the Far East. This Super-Station is situated at Rocky Point (seven miles east of Port Jefferson) on the northern shore of Long Island, seventy miles from New York City. The station site covers 6,400 acres or 10

square miles. The construction began in July, 1920, and the first test signals were sent in October, 1921, a little more than a year later, a record in itself when one considers the great amount of work accomplished. 1,800 tons of structural steel were used to erect the first twelve towers, each employing approximately 150 tons. Each tower is 410 feet in overall height and the cross arm or bridge supporting the antenna wires at the top is 150 feet long. 8,200 tons of concrete were employed for the foundations of the twelve towers, the base of each tower leg being sunk nine feet below the ground with a total base area of 360 square feet. The distance between two adjacent towers is 1,250 feet or nearly three miles from the first to the twelfth tower.

Each antenna consists of sixteen silicon bronze cables  $\frac{3}{4}$  inches in diameter stretched horizontally from tower to tower. In all, fifty miles of this cable has been used for the first two antenna systems. The ground system for both antennae consists of 450 miles of copper wire buried in the ground in starfish and grid-iron fashion. The first power-house section covers a space of 130 feet by 60 feet and accommodates two 200 K.W. high frequency transmitting alternators with auxiliaries and equipment. A sending speed of 100 words per minute is possible with the use of each transmitting unit at Radio Central. This means a combined sending capacity of 200 words per minute for the two completed units. The present wave length in use is 16,500 meters. The erection of additional antenna units forming the spokes of the huge wheel and further improvements which are being made will correspondingly increase the transmitting capacity of the big station.

The transmitting range of Radio Central is practically world wide, as demonstrated at the official opening when the station was heard in all parts of Europe, as well as Australia, South America, Japan, and New Zealand.

The cooling pond for cooling the water after it has circulated through the high speed alternators covers a ground space of 64 feet by 42 feet and is 7 feet deep. The pond is equipped with four spray heads which, when operating, present a beautiful and ornamental appearance.

The community house for the staff is a low one-story building closely resembling an exclusive country club. It contains sixteen single rooms, an official suite, a large living room and dining room as well as quarters for servants. The engineer in charge with a staff of fifteen assistants comprises the personnel necessary to maintain the huge station in operation at present. The 23,000 volt transmission line was built from Port Jefferson to the station, a distance of seven miles. There are no radio operators at Radio Central, the actual transmission taking place by remote control

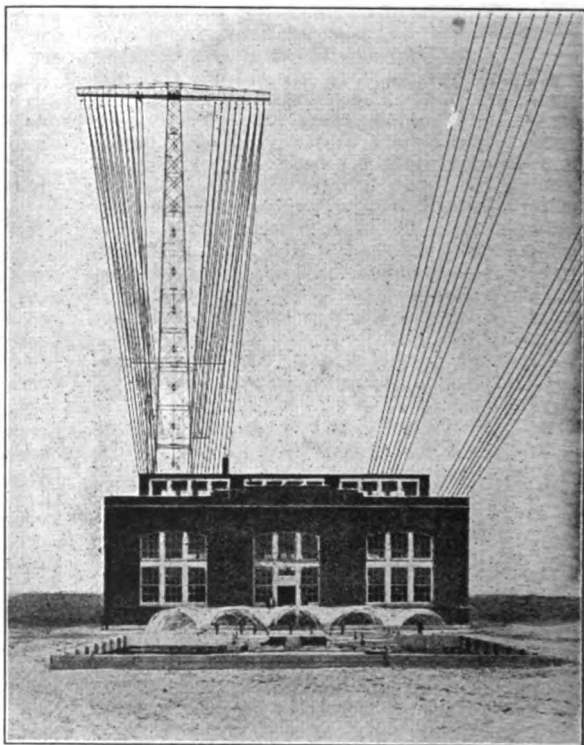
from the Central Traffic Office at 64 Broad Street, New York City.

The receiving station working in conjunction with Radio Central is located at Riverhead, L. I., sixteen miles away. No operators are located here, for the distant signals are first received by radio, automatically transferred to wire lines and received at audible tones at the central traffic office, New York City. The action is automatic from the time the signals are transmitted abroad, picked up by the aerial, to the moment of actual transcribing by the receiving operators in New York.

The final installation at Radio Central will comprise twelve antenna units supported by 72 towers, forming so to speak the spokes of a giant wheel nearly three miles in diameter. Ten high-frequency alternators will be employed which in total will give a power output of 2,000 kilowatts or 2,700 horsepower. The electrical force thus brought into play at Radio Central permits the realization of the vision of communication engineers to transmit messages to all points of the world from a *single* centrally-located source.

The station was officially opened by President Harding on November 5, 1921 who took advantage of the occasion by sending a message addressed to the entire world. The sending of this message was accomplished as follows. It was first punched out on a tape by means of the Kleinschmidt perforator and then passed through a Wheatstone automatic transmitter. At a given moment, the President closed a switch near his desk at the White House and the message sped on its way from Washington to Rocky Point via the medium of a direct wire connected to the sending relay at Radio Central from where of course it was broadcasted. Something like thirty-three nations heard the President's message and these immediately acknowledged it by means of the quickest available method. Some of course, not being equipped with high power transmitters, cabled their reply but the majority came by radio. Incidentally, a world record for long distance radio communication was established at this time when far-off Auckland, New Zealand, a distance of over 10,000 miles, easily copied the message and reported the signals quite strong and reliable.

An interesting contrast to this record transmission is furnished us by some remarks exchanged between Guglielmo Marconi and a reporter twenty-five years ago



The Power House at Radio Central.

during an interview shortly thereafter published in McClure's Magazine for March, 1897:

—"And how far do you think a despatch could thus be sent?"

"Twenty miles!" (replied Mr. Marconi).

"Why do you limit it to twenty miles?"

"I am speaking within practical limits, and thinking of the transmitter and receiver as thus far calculated. The distance depends simply upon the amount of the exciting energy and the dimensions of the two conductors from which the wave proceeds."

Twenty miles in 1897—10,000 miles in 1922. In the comparatively short span of 25 years, radio communication has certainly made tremendous progress.

There is another little matter too which may have occurred to you and this has to do with the recent trans-Atlantic amateur test. Mr. Godley had no sooner assured us that amateur short wave communication across the Atlantic was an accomplished fact that some of the general public began to ask "how come" the fact that amateurs could with their "home made" sending sets send across the Atlantic with as low as a

50-watt tube when it took the commercial stations 200 kilowatts more or less of electrical energy to do the same thing. It has been a hard job convincing these wise folks that telegraphing across the pond with comparatively small power at a special prearranged period at a most favorable time of the year under best possible conditions was one thing and to telegraph across the Atlantic with comparatively great power under all and any condition, winter and summer day and night and at

high speed was quite another proposition. To you of course, familiar as you are with the wiles of radio, it is quite understandable but it is a different thing to prove it to the casual observer. I bring it to your attention only because to some it may seem rather incongruous to feature Radio Central at this time when we have not yet recovered from the glorious achievement of American amateur radio and its international communication possibilities.

## Revision of Fire Underwriters' Rules

THE National Electrical (Fire) Code embodies the regulations formulated by the National Board of Fire Underwriters to insure the safety of buildings in which electrical installations of any kind have been made.

If these requirements are not met, insurance may be refused entirely or only granted at a much higher rate. Rule 86 of this Code covers the installation of radio equipment and in connection with the general revision of the code now in progress, it has been decided to revise this rule.

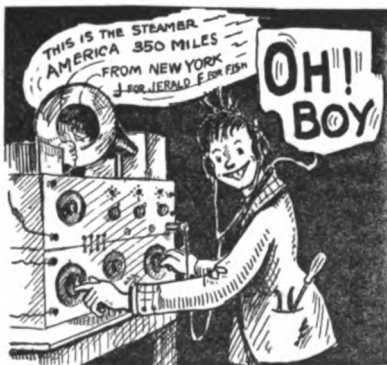
Certain tentative requirements have already been drawn up and published in mimeographed form as Letter Circular 62 of the Bureau of Standards. Any one especially interested in this subject may obtain a copy by writing to the Bureau, and suggestions concerning the changes in the code will be gladly received by William S. Boyd, Chairman of the National Fire Protection Association, 175 W. Jackson Boulevard, Chicago, Ill., until September 1, 1922.

Meanwhile the proposed changes are being followed by local inspectors to obtain "field experience", which will be the final test of merit in determining whether or not the changes will be formally adopted this coming fall. Representatives of various interests concerned have met in conference many times in the past year to discuss these matters. Our A.R.R.L. has been duly represented, by a technical committee headed by Mr. R. H. G. Mathews of 9ZN as Chairman, and at the later sessions by our former vice-president Mr. C. A. Service, Jr. For once in its life our A.R.R.L. has been in the (for it) peculiar position of favoring more restrictive rules and opposing a field whose sentiment it was to ease

up on the regulations, which is quite contrary to the attitude which perforce has been our representatives' in radio legislative matters from time to time. In this case the tendency to ease up on the fire protection regulations was so influenced at times by the desire to make it easy for Mr. Everyman to have a radio set that proper and desirable protection was being sacrificed, in the opinion of our representatives.

### Regulations for Receiving Stations

The proposed rules for receiving sets provide that aerials shall not pass over or under circuits of more than 600 volts; that the lead-in shall enter thru a bushing and shall not be smaller than No. 14 copper or No. 17 copper-clad steel wire, B. & S. gauge. An antenna grounding switch will no longer be compulsory but is still desirable; in any event, however, protection is to be secured by the use of an "approved lightning arrester which will operate at a potential of 500 volts or less", which shall be connected



and located as near as practicable to the point where the lead-in enters the building. When an antenna grounding switch is installed it shall in its closed position form a shunt around the arrester. The same gauges apply to the protective ground wire as to the lead-in. Water piping is endorsed as a good ground connection but gas piping is barred. It is to be noted that the protective ground may be indoors or out. The receiving set ground wire also must be not less than No. 14 copper or No. 17 copper-clad steel and if run in full compliance with the rules respecting the protective ground wire, it may be used for both purposes.

### Transmitter Regulations

Transmitter lead-ins shall not be smaller than No. 14 B. & S. gauge and all h.f. conductors must be firmly mounted five inches clear of building, etc., and both aerial and counterpoise lead-ins shall enter thru a bushing or tube having a distance of at least five inches to extraneous bodies. A drilled window-pane is OK'd. Antenna lead (and counterpoise as well, if used) shall be capable of grounding thru a double-throw knife switch having a break distance of 4 inches and a blade not less than  $\frac{1}{8}$  inch by  $\frac{1}{2}$  inch, this switch being mounted to clear the building wall, etc., by at least 5 inches. Slate bases are not recommended. It is at present contemplated that the switch may be located either inside or outside the building. The protective ground wire shall be at least as large as the lead-in and not smaller than No. 14 B. & S. Preference is given water-piping as an earth connection, with gas piping prohibited. The operating ground shall be of copper strip not less than  $\frac{3}{8}$  inch by  $\frac{1}{4}$  inch or of copper or copper-clad steel having a periphery of at least  $\frac{3}{4}$  inch (for ex-

ample a No. 2 B. & S. wire). Neither ground need be insulated.

When street mains supply the power the circuit shall be installed in approved metal conduit, armored cable or metal raceways, even if lead-covered wire is used. A surge-protector shall be installed close to and on the supply side of every transformer, gap motor, generator motor, etc., consisting of one of the following: (1) two condensers (not less than  $\frac{1}{2}$  mfd., 600-volt test) in series across line with mid-point grounded, and each condenser shunted by a fixed spark-gap not over  $\frac{1}{4}$  inch separation; (2) two vacuum type protectors in series across line, mid-point grounded; (3) non-inductive resistors across line, mid-point grounded; (4) electrolytic arresters such as the aluminum cell type. In no case (thank heavens!) shall the ground wire of the protective device run parallel with the operating ground wire when within a distance of 30 feet nor may the protective ground be connected to the operating ground or ground wire.

We live in hopes.

—K.B.W.

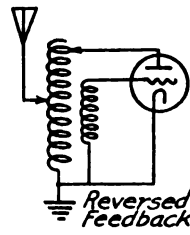
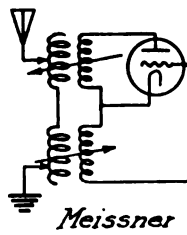
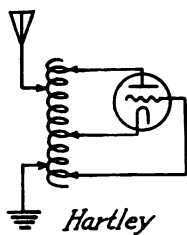
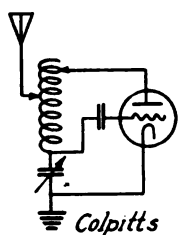
## Circuits

THERE is much confusion among amateurs as to the proper name for the type of transmitting circuit they use. There are only a few basic types and just a few words will clear up the matter for keeps.

In the first place these are all Armstrong circuits, in that they make use of the feedback principle discovered by E. H. Armstrong. Different investigators subsequent-

this circuit that the r.f. power is introduced into the aerial circuit by means of charging the condenser formed by the antenna. In other words, it is a capacitively-coupled circuit.

The Hartley is the simplest of the electromagnetically-coupled circuits. It is sometimes known as the "split-inductance" hook-up, the filament tap to inductance being between the anode and grid connec-



ly developed their own trick oscillators, each particularly suited to their own purpose, and their names are commonly associated with their circuits. There are a great number of such hook-ups but four chief ones which are encountered daily. A few words on each will enable the reader to identify the oscillators he sees in his later reading.

The Colpitts circuit has as its distinguishing feature a series condenser in the ground lead, across which the grid and filament are connected to secure a direct voltage feed-back. It may also be shown in

Ordinarily aerial and ground connections are taken off this same inductance, but the closed oscillator of Hartley's may be inductively coupled to the antenna circuit and the arrangement still be a Hartley.

The Meissner circuit differs radically from the Hartley, even from the coupled Hartley circuit, in that the grid and anode inductances are not electromagnetically coupled to each other. Instead, each is coupled independently to the antenna circuit inductance. If anode and grid circuits are coupled directly to each other, it is not a Meissner circuit. Over a considerable

band of frequencies the Meissner circuit will work without change in grid or anode inductances, the said circuits functioning aperiodically and the wave length being determined by the adjustments of the aerial circuit.

It's somewhat difficult to find a name for the last circuit shown, which differs considerably in its action from any of the others. Its nearest neighbor is the Hartley. If that portion of the Hartley inductance comprising the grid circuit be bent back and telescoped within the remainder of the inductance, we get this new arrangement, which has been called the "reversed

feedback" circuit by Mr. R. A. Heising. In bending back this portion of the inductance to form a grid tickler it is necessary either to reverse the direction of its winding or to reverse its terminals—whence, presumably, its name.

The student of circuits will find much that will interest him in a most comprehensive and profusely illustrated article by R. A. Heising entitled "The Audion Oscillator", appearing in the Journal of the American Institute of Electrical Engineers for April and May, 1920.

— K.B.W.

## QRM--Local and Domestic

By Gordon Peck, 2HC

**W**HO was the guy that said, "There's always something to take the joy out of life?" I'm sure I don't know but nevertheless there is much truth contained in those words.

Wireless is no exception. Ah, how well we amateurs are aware of it. We talk about it, read about it and worst of all we are compelled to listen to it. You all know what IT is. QRM is the answer. Every effort is being made to conquer it and through the help of the A.R.R.L. and the hearty co-operation of the amateurs, the local part of it I'm sure, will be eradicated to a certain extent in the near future.

Local QRM, although by far the worst enemy, is by no means the only one. Take for instance Domestic QRM. Oh boy, there is no real wild and wooly amateur that ever escapes this terrible mutilation of his tranquility, especially if his family has a full complement of brothers and sisters.

For example take George, an honest-to-goodness BUG who would like nothing better than to grab up about ten thousand dollars worth of nifty instruments, VT's and the usual junk, build himself a shack on top of the highest mountain he could find, safe from all intruders, where he could jab away at the old key to his heart's content and not even have to stop for meals.

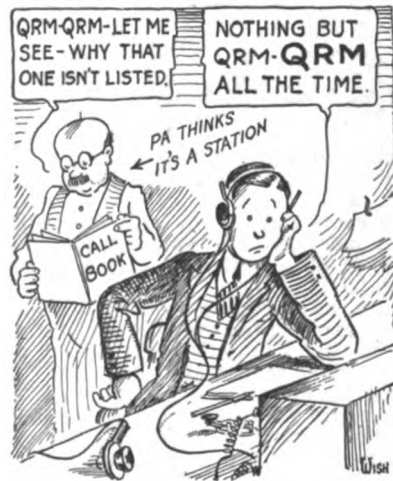
But alas! George is no exception nor is he any privileged character, having to go to school just the same as the other fellows and (in his mind) waste a perfectly good six hours a day for six days in the week.

Of course all he ever thinks of in his English or History period is that new book-up or something-or-other and to his bitter misfortune he generally gets called upon to answer some fool question on Ancient History. Naturally it always comes just as he is carefully scribbling out the swellest little diagram of how to make a crystal oscillate or somethin' that you ever saw. As usual, dire calamity follows,

the result being something like this:—

"George Smith, what did Caesar say to Brutus in his last breath?"

Poor George stiffens a bit and scrambling to his feet, sputters out something like this, "Did you call on me, Teacher, er-er-why-er-Caesar didn't strike h-his wife t-tall he-er—?"



"STOP"—cries the teacher, "That will be enough, George Smith, take your seat. You are very inattentive."

Whereupon poor George takes his seat amid much gloom and humiliation yet secretly glad that's over with.

At last the bell and, hootin' cooties, what a rush! George's one and only idea is to get home to his shack as soon as possible if not sooner. Immediately on entering the room he quickly dashes to the table, slams in a switch, clamps the cans over his noble dome and from thence on is lost to the world.

Now right here is where the Domestic QRM comes in. It usually begins like this: "Oh Georgie, Georgieeee, Georgieeeee do you hear me?"

Georgie reluctantly hashes out some QR's and an "AS OM" and slowly proceeds to the head of the stairs:

"Yes, Ma."

"George, I want you to go to the store for me right away. It will only take you a few minutes."

"Oooo Gee, Ma could you wait just five minutes more and I'll promise to come right down."



"Alright only five minutes now."

A few minutes later, "Oh Georgie!"

"Yes, Ma."

"You come right down here this minute. Bridget must get the washing done today and she is all out of soap so you must go immediately."

No use, he's been up against this before and past experience says go to it. So, with a, "Sorry Ma, I forgot" and a minute more in the shack to send, "QRX PSE OM CUL" he makes his exit.

Back again from the store he immediately begins his pounding of brass, thinking that at last he is free, when to his horror along trots little Sis with:

"I'm going to Jimmie's for supper and Ma says its too far for me to go alone so you will have to take me over."

"Sufferin' catfish, can't you go alone, why the—Oh what's the use, I suppose I'll save time by going right away. Hurry up, Sis, and get on your duds," and he's off again.

A while later George returns with the idea that at last he will be unmolested, when to his dismal shack comes the sweet notes of the dinner gong and now no hope until after grub. He is at least thankful that in some mysterious way his homework is all done and he won't have *that* to bother him.

But this Domestic QRM is not so easily gotten rid of, for no sooner does he get settled down for a nice long chat with 8PDQ, 6BVD or some other distant station, than in rushes Kid Brother with some undone Algebra and as father has gotten just a bit rusty in math in his old age it is naturally up to poor George and again he is compelled to make the great sacrifice.

And so it goes day in and night out, at least so it seems to go to George but as a matter of fact—Shhhh! don't say a word, Georgie makes good use of it very often as an excuse for a QTA to some bug who is sending just a little too fast, George in turn replying with a "Sorri OM bt QRM radio room."

### THE LACKAWANNA PHONE EXPERIMENTS.

(Continued from page 26)

about 65 miles per hour, the voice being very clear both ways and heard all over the car. 8RH and 8BUW were worked in Scranton. 8BUW was repeating back a message when the train went thru a tunnel with hardly noticeable effects on the signals. Two way communication was carried on for twelve miles until going around a mountain when 8BUW was lost and not picked up again until the train had ascended to a large lake. Here 8ADQ and 8AOE were also listed.

A summary of the log between 5:15 and 7:10 p.m. on March 26th following stations were heard in the order named: 2BRB QRZ, 1RX QRK, 2BK QSA, 1RX QSA, (about 40 miles from Scranton going 60 miles per hour) 1ARY loudest so far, 2BM QRK, 1RX very QSA, (now passing over plain and signals much stronger) 1CNI QRK, 1BQL QRK, 1GM very QSA, 2AHU QSA, 1ADL very QSA, 2ACY QSA (near Blainstown, N. J.)

Mr. Richardson explains that when he lists a call followed by "QRK" he means it was readable about 70 feet from the loud-speaker with the train windows open and "QSA" means readable about two blocks away when the train happens to be at a station. During the evening of April 5th the following were picked up: 2BFX, 1CK, 3ZO, 8CGZ, 1WQ and 9YB all very QSA; 8AWU, 8AHE, 8TT and 8AVT all QSA; 1AZK and 1CO both QRK; (11 P.M.) 8AVT, 8DK, 8WD, 8LQ, 8RQ, 8AJU and 9ME all very QSA; 8XE, 9AZA, 1AW, 9DCX, 1BVB, 1XAB, 1BRQ and 8CGZ all QSA; 2ACD, 8ANO, 8AYV, 2AHN, 3AGT, 8AJV and 8ANK (?) all QRK; (12 mid-night) 9AZE, 9UU, 1SN, 9AGR, 8XZ, 9DKY, 3ARN and 8OZ all very QSA; 8LQ, 8GC and 8AGO all QSA; 8AWP, 8ZQ, 9AUL, 9OX and 8AAG all QRK.

"The loudest station of all, I think, for long distance, was 9DCX, which was little less than brutal," says Mr. Richardson.

(Concluded on page 40)

# EDITORIALS

## de AMERICAN RADIO RELAY LEAGUE



### Our QST

WITH all the other magazines turning eagerly to popular radio because of the greater financial reward to be obtained in the big field of broadcast fans, we are more than ever determined that QST shall remain a magazine "of, by and for the amateur".

Our Board of Direction recently had to consider the question whether or not our QST should be changed into a popular magazine devoted to "the man in the street", in order to survive financially. Some cool and collected mind on the Board asked "Why? Why should we? QST is the mouthpiece of our association of amateurs, and if we can't support it as such it's time we quit". That judgment prevailed, of course, and it justifies itself more every day. There *shall* be one magazine devoted to the practical amateur! It isn't worth a cent to us amateurs to own a magazine telling how to copy broadcasts on a needle stuck in a potato for an aerial and a ground in mother's flower-pot, or in tedious answers to "how far away is 200 meters?".

There's another angle to this thing, too. All the broadcast listeners aren't "dumb-bells", as T.O.M. has it—not by a jugful. A great many of them are going to become real amateurs and they'll need a real amateur magazine. They'll be wanting to transmit and they'll outgrow single-circuit tuners and they'll be curious as to what's happening in their sets. There is where QST will come in—we *purpose to continue to be a magazine devoted to the practical improvement of short-wave two-way communication!*

While we're talking about new-comers and listeners and things we want to protest the occasional characterization of the new radio folks as amateurs. They're not amateurs. An amateur is one who pursues a line of endeavor for love thereof and not for commercial gain. Broadcast listeners of course have no financial incentive but neither are they interested in radio as such, but rather are concerned only about hearing something and hang how they get it. They're not amateurs—they are *radio fans*, novices. We hope that some day they'll become amateurs but they are not today.

QST then is for us amateurs. Let us support it and boost it in order that we may

have a constantly-improving forum in which to club our ideas. The life of any magazine is dependent upon its advertising and advertisers don't advertise except where they get results. It is therefore the duty of us amateurs always to mention QST in writing advertisers, letting them know that the business comes because they advertise in our magazine. This support from our members, always an important thing, is more than ever vital in this day of over-sold factories and many magazines. "Always mention QST when writing to advertisers", please—it helps all of us. And tell the new folks about QST; they drift into wireless rather accidentally and it may be weeks before they hear of the A.R.R.L. and its magazine. Put them next, so that they may learn of an amateur magazine and, as they awake to the knowledge of what it means to be an amateur and a member of the League, they will be one with us in the support and improvement of our QST.

### Opportunity

SOMETHING is about to happen in radio reception methods. We don't know what is coming but something seems about to arrive and the air is charged with expectation. It seems fairly certain that present day systems of radio receiving are about to be vastly improved, so greatly increased in efficiency that what we will call modern equipment will ere long be regarded as crystal detectors are today.

A rumor of a new method of reception is worth exactly nothing. But when carefully guarded reports start drifting about from several places one begins to wonder if where there is so much smoke there might not be a little fire after all. For example, it seems well established that Armstrong has a method of "super-regeneration" little short of revolutionary, which he is almost ready to announce to the world. Dame Rumor has it that, using two valves, the new system produces telegraph signals around a million times as good as a single regenerative audion of today. Somewhere we picked up the report that the idea is to prevent "spilling over" as the oscillating point is approached in regeneration—in other words, to be able to carry regeneration on and on without breaking into oscillation—and that this is done by feeding alternate negative

and positive resistance into the detector circuit, the resistance effects being created by the second valve. From France comes a report of a remarkable improvement in C.W. telegraph reception wherein, instead of heterodyning the incoming signals by means of an oscillating detector, the signal trains are caused to modulate the oscillating output of a feeble oscillator almost exactly as in a present-day constant-current radio telephone transmitter, with results said to be much improved over the more usual arrangements. Dr. Chaffee of Cruft Laboratory has something up his sleeve, too—something involving “antenna circuit regeneration” in addition to closed circuit regeneration, some more of the business of coupling a generator so as to feed negative resistance into a circuit to reduce its decrement and increase the current effects produced in it by the signal.

Much thought is being expended upon radio frequency amplification itself and also there is still considerable to be desired in its performance on 200 meters and below, undoubtedly it will be “whipped” soon.

We should say that a remarkable opportunity to produce wonderfully-improved reception awaits the amateur who can devote some time to intelligent experiment in these directions. Perhaps a new line of thought will be opened up which will lead on to another epoch-making invention; in all probability that amateur will enormously improve his station's receiving performance, which in itself is sufficient reward; and at the very least he will have had a most interesting and instructive course of experiments in electron tube action. Why don't you try it?

## Men Wanted

**A**RE you an amateur? If so, do you belong to the American Radio Relay League? If you don't, please read on:

There's an association of amateurs—the real amateurs who do things—known as the A.R.R.L. The only requirement for membership in it is the possession of a bona-fide interest in amateur radio. Accordingly almost anybody who wishes to can become a member but the radio fans who are only casually interested in wireless are not likely to find much in the A.R.R.L. which appeals to them. If you, Mr. Reader, are concerned only in the reception of signals and have never a stray thought as to what is happening in your set or why, or about how to improve results, then turn to something else in QST to read because this page won't interest you. However, if radio appeals to you for radio's sake, if you're actually interested in finding out what is going on, if you like to experiment with radio and can get a thrill

out of making your own apparatus perform for you, then either you're an amateur or you're rapidly becoming one. And in either case you ought to belong to the A.R.R.L.

The League is a national organization of men like that. It is “of, by and for the amateur”. Its directors and officers elected by its membership, are prominent amateurs. It governs its own affairs. It is not organized for profit and has no capital stock and no owners except its members. It is the standard-bearer in amateur affairs, recognized by the government as the spokesman of the American amateur.

The A.R.R.L. is primarily interested in radio telegraphy. Anybody can understand a phone and so it soon palls, but telegraphy goes on forever. The obvious activity of the League is the relaying of friendly messages by telegraphy between its member-stations, without charge and for the fun of the thing. Radio of course is a hobby, and capable of being followed in many ways. The method pursued by the League we feel is an entrancing one, and one which has stood the test of time. Relaying provides every possible working test for apparatus, teaches real operating, establishes a splendid fellowship amongst amateurs, makes co-operation absolutely imperative.

But the A.R.R.L. is much more than an organization of relayers. Its members stand united for legislative representation and protection, as a power for the enforcement of orderly operating and the courteous use of the ether. Above all it is a gang of *deers*—active lovers of the wireless game who, thru the co-operation afforded by their bonding into a national society, are able to stage special amateur radio affairs which provide an enjoyment of radio not to be found in desultory listening to radio telephones. *We relayed a message from the Atlantic to the Pacific and the answer back to the Atlantic in six and a half minutes! Our west-coast stations talk to amateurs in Hawaii! Scores of our member-stations have been heard in Europe and soon we'll be able to talk with amateurs there regularly.* Every night our thousands of members get on the air together and talk to each other, relay messages, make friends, *enjoy radio.*

You can do these things too, if you want to. Radio amateurs are ordinary human beings. It doesn't require a super-bean or a millionaire's income to build and operate a real station. You can learn to do these things and have just as much fun as the rest of us—if you have the inclination to become an amateur.

The A.R.R.L. would like to have you as a member, if you are interested. Bona-fide interest is the requirement. The only charge is the annual dues of \$2.00, which also includes a year's subscription to this magazine, QST. COME ON IN WITH THE GANG!





### A NEW DEPARTMENT

In recognition of the rapid approach of the day when American amateurs will work across both oceans with comparative ease, and for the assistance of the amateur movement in other countries where similar aspirations are possessed by radio experimenters, QST establishes this department, which will be devoted to the presentation of information particularly looking towards the establishment of international amateur relay work.

Communications and news items of interest, particularly reports of amateur activity in foreign countries, are solicited.

It surely seems that regular international amateur communication will be an accomplished fact before long. As a direct result of our A.R.R.L. Transatlantic Tests great interest is being shown in the subject in many corners of the world, and we have the feeling that next fall will see its realization.

Amateur work with Canada, of course, we have had so many months that it is now a commonplace; yet do not all of us remember the real *thrill* that came with the knowledge that here were amateurs of two different countries actually breaking thru national barriers with private radio and knitting themselves into a common brotherhood? In just that same way we believe the amateurs of one country after another will come onto the air with us, and in not many months we will have an international affiliation. And Oh Boy! the thrill then! They're not all gone out of amateur radio yet—not by several micros.

As reported in the last QST, 6ZAC in Hawaii has established two-way communication with the U.S., and details of this remarkable work are found in this department. In our April issue we told of the tests of 3ZO with Venezuelan stations, and in our next issue we will have an interesting account of conditions in Porto Rico, surely justifying the expectation that the amateurs there will be QSO the U.S.A. by next fall and linking us with Latin-America as soon as the latter is ready. They're coming there too, fellows—there are amateurs in nearly every important city in South America, under restrictions it is true but getting

sufficient authorization in many special cases to make possible amateur intercommunication with the southern hemisphere. Around Buenos Aires in particular there are several good private stations, one at least having a phone with a range of several hundred miles.

In Holland there are many enthusiastic amateurs, most of whom speak English. No transmission is permitted there yet, but with Britain and France recognizing her amateurs we do not believe it will be long before the Dutch amateurs are accorded similar privileges.

Now for good news! In France the lid is off and amateur transmitting licenses are being issued! We have heard that the general limits are put at 100 watts of C.W. on 200 meters. While that is not overly generous, we immediately have hopes of connecting up with them. Just a short while ago the French amateur magazines were publishing lists of British amateur calls and wondering if ever they could publish any of their own. We join with hams the world over in offering hearty congratulations to the French amateurs. FB, OM!

The French calls so far issued are similar to those in our own country, running 8AA, 8AB, 8AC, etc., and already quite a few licenses have been issued. The power and wave length vary, it seems. For example, 8AB is Mr. Leon Deloy, Nice, who has something over 5 amperes of C.W. in the antenna on 525 meters. Mr. Deloy was attached to the U.S.N. Communications Office at Washington during the war, and is well known to a number of American amateurs. 8AD at Juvisy-sur-Orge at present has a 900-cycle spark on 200 meters, 0.7 amp. in the aerial, but with a C.W. set coming up. 8AE in Paris has C.W. on 200 meters, and 8AH has C.W. and phone on 200 meters; etc. Soon we'll have to send our fifteen cents to Paris for a French call-book.

Mr. Deloy seems an easy leader in the new French amateur field. Dr. Corret, editor of "La T.S.F. Moderne", speaks of him as their "A.R.R.L. man". He has had much the same experiences with C.W. as we fellows have—for a long time 2 amps. was his maximum, then he "got the com-

bination" and now he has 5 amps. This is obtained from two 50-watt tubes with 2000 volts A.C. on the anodes. Mr. Deloy works nicely with Friend Burnham in London, roughly 600 miles; Blackpool, Aberdeen, and other points in the British Isles at distances up to about 1000 miles.

In Great Britain things are humming. Numerous amateurs are now keen on hearing U.S. signals and it looks like there should be several hundred of them outfitted sufficiently for this purpose by next fall. There are between two hundred and three hundred transmitting licenses issued in England now, under restrictions of course, but the prospects for high-powered amateur transmission in special cases seem equally favorable. For example, the Manchester society, in conjunction with Mr. Burne, British 2KW, the most successful of the British contestants in the Transatlantics, have received permission to use a special aerial and a power of 1 k.w., C.W., which was granted them especially for the purpose of endeavoring to connect up with American amateurs. Fellow U.S. amateurs, these English amateurs are out to transmit to America and they'll be on the air very shortly with a big kilowatt of C.W. We've a job ahead of us, to get busy on reception methods and be ready to copy them when fall weather comes. We're better now on transmission than we are on reception, and we will have to overcome that if we have international aspirations.

The British amateurs want to improve their receivers and want us to send every night at an earlier hour than our DX work usually begins, as it is a killing job to sit up every night until 6 a.m. in quest of sigs. What they need is signals around 6 to 7:30 p.m. Eastern Standard Time, and we are advised that there are qualified amateurs in London, Manchester, Birmingham, Liverpool, Blackpool, Aberdeen, etc., ready and anxious to listen. Our Operating Department probably will conclude arrangements for special tests at an early date.

The English amateurs are getting on quite well. It seems probable that the 1000 meter wave length will be abandoned there, and 400 used instead, which is gratifying. Most of their work at present is phone, C.W. telegraphy being rarely used and spark never, the average wave being 350 meters. They are specializing on low-power transmission and ultra efficient reception. Their 50-watt phones cover the country; for example W. W. Burnham in London is regularly phoning as far as 2JZ in Aberdeen, 500 miles, on ten watts, day or night using two valves for reception, one radio frequency amplifier and one detector while with 2 amps. on 360 meters he works voice to French 8AB in Nice.

The next winter is going to be a memor-

able one, fellows. Our cue is to do our utmost during the coming summer to bring our equipments to perfection in point of both reception and transmission. If we don't we will fall down in a wonderful opportunity, while if we do—the world is ours!

—K.B.W.

We ought to be able to hear French 8AB's five amps. of C.W., strays permitting. Mebbe Godley will dust off the ol' Super and give it a whirl from—Otter Cliffs would be a good place.

3ALN in Washington, D.C., and 8YD in East Cleveland, Ohio, report the signals of 6ZAC of Hawaii. 6ZAC has retaliated by reporting 1XM at 7:10 p.m. H.S.T. on April 14, on 200 meters. Some DX!

We wonder what next. And where oh where are the Sparks these days?

Messrs. Burnham & Co. of London announce that, owing to the growth of business it has been necessary to transfer their wireless department to a new company, "Burndept Ltd.," with offices and factory at Blackheath, S.E.3, and showrooms at 228 Shaftesbury Ave., New Oxford St., W.C.2. Demonstrations are given on most Sunday afternoons and a cordial invitation is extended to all American amateurs who happen to be visiting in London to call on them.

The A.R.R.L. Board of Direction has a committee known as the International Advisory Committee of the A.R.R.L., whose function it is to aid in the development of amateur relay work in foreign countries. The League does not believe it wise to undertake the formation of foreign branches of the A.R.R.L. even upon request but will gladly be of every possible assistance in the formation of societies "of by and for the amateur" in such countries. Correspondents desiring data are invited to address the League secretary.

And now a little relay, record: On April 21, 6ZF ex-6ALE worked NOF in Washington, D. C., direct and took a message for Hawaii, landed it immediately to 6ZAC in Maui, and in a few minutes passed the answer back to NOF. Washington to Hawaii with but one relay. Hot dawg!

#### Foreign Periodicals

It is interesting to read the foreign radio magazines. There is much in them that is new to us and we find them particularly holding our interest when they deal with amateur problems in their countries. For the information of our members we present a list of those known to us, with their U.S. subscription prices.

The two leading British periodicals are now combined in a weekly, known as "The Wireless World & Radio Review". Address 12-13 Henrietta St., Strand, London, W.C.2. Subscription 28 shillings per annum.

In Holland there is "Radio-Nieuws", the monthly organ of the Nederlandsche Ver. voor Radio-Telegrafie, printed in Dutch. Rate 10 florin per annum. Address the secretary, B. Slikkerveer, Columbusstraat 187, The Hague.

France has several radio magazines. "L'Onde Electrique" is a new monthly, organ of the Societe des Amis de la T.S.F., subscription 35 francs. Address J. Cornu, 102 bis, rue Didot, Paris XIV. "La T.S.F. Moderne", which frequently has been quoted in QST, is published at 11, Avenue de Saxe, Paris VII, rate 36 francs per annum. There is also an engineering periodical, "Radioelectricite", published by the Societe de Publications Radiotechnique, 12, place de Laborde, Paris (8'), subscription 36 fr. per year.

In Italy there is "L'Audion", published twice a month by Audion, Via dell'Alloro 19, Firenze, as the organ of the Radio Club d'Italia. subscription rate 50 gold francs per annum.

We would be pleased to learn from our readers of any other foreign publications of possible amateur interest.

#### The Hawaiian Achievement

A.R.R.L. members are hereby advised that relay traffic for Hawaii may be accepted. It should be routed via 6ZAF, 6ZQ, 6ZR, 6ZB, 6EX, 6ZI, 6ZF or 7YA, all of whom are regularly QSO 6ZAC in Maui.

Thereby hangs a tale. In December last West Coast amateurs were given a thrilling kick by receiving word from Hawaii that they were being copied there extensively by C. J. Dow, then located on the island of Kauai. Mr. Dow had call letters of 6ZAC but no transmitter, and of course wanted one, in the hope of connecting up with the mainland. In a number of personal letters to 6ZAF he expressed a desire to have a set similar to 6ZAF because of its good clear signals, and accordingly a set was designed for him on these connections by Mr. G. M. Best, built in San Francisco by Mr. Heintz, and presented to 6ZAC by the magazine "Radio" in consideration for certain work he is doing for that journal. The new set was tested at Berkeley and heard OK by Dow, whereupon it was knocked down and shipped to him. Of course those in on the game counted the days until the time the packages should reach him and the probable time it would take him to get into operation. On April 11th and 12th 6ZAF sent him long broadcasts in response to a letter, giving directions for tuning the set and approximate location of helix clips, etc., and arranged to test with him at 11 p.m. the 13th. The

following evening, unfortunately, 6ZAF was ill and confined to his bed, but 6ZAC's call was heard by 6ZQ, Berkeley, who immediately went back at him using 750 watts in a 500-cycle Telefunken spark transmitter with 10 amps. in a T aerial 40' long and 55' high. 6ZAC replied at once. They exchanged greetings and then passed messages, making a date for 1 o'clock the next night. The next several nights they worked with ease, sending single at a good clip with practically no repeats.

We asked Mr. Babcock of 6ZAF to tell us of his experience in linking up with 6ZAC, and we quote part of his letter:

"Of course the glad news was handed around the following day by local telephone and other means of communication, so that on Friday evening, the 14th, practically the entire Coast was standing by for Dow's signals. At about five minutes to eleven, while I was waiting for the scheduled hour to come around, I was suddenly pulled up with a jerk, hearing my call and the signature 6ZAC; and it's here the fun began. I went back at him promptly, and from eleven o'clock until nearly one, we worked continuously and without interruption, because everybody in the neighborhood was listening either to him or for him. It was fun to hear the chirpings of the various regenerating receiving sets in the neighborhood trying to get on his wave. Just before one o'clock—after more than an hour and a half of continuous communication—I told him that while I was getting a real thrill out of one of the rare experiences of life, I did think it was only fair to the others that I should let go and give someone else a chance. The instant I signed off, our neighborhood passed from absolute silence to bedlam. I picked out stations all the way from Vancouver to Arizona, all trying at once to be the next in line.

"On Saturday evening, the 15th, at about 10:20, I was calling 6ZX, and while listening for his comeback, heard just this "6ZAF de 6ZAC," to which I replied with out thought, in the old land Morse fashion, "II GA"; and we were at it again.

"The traffic is being handled regularly every night back and forth. A few nights ago both 6ZQ and I heard Dow working some Honolulu station, but with out hearing the latter. Also, Dow must have been on reduced power because his signals were very faint.

"The greatest interruption to our communication comes from CL8, who uses spark with high power directly on our wave; in fact with enough power to break Dow's reception completely. Inasmuch as this is an Army station it seems to be out of our reach to control."

On April 16th 6ZAC blew a tube and was temporarily kept off the air until new ones reached him by steamer. He uses two 50-

watters in a full-wave self-rectifying circuit.

For some unknown reason signals reach 6ZAC with extraordinary clearness. He hears the concerts of the Seattle "Post-Intelligencer", has reported 1XM, and mentions that a number of other stations "including 2FP keep pounding in pretty regularly". He is on the ocean side of a range of mountains some three or four thousand feet high, with nothing but open sea in front of him for more than two thousand miles.

QRX soon, everybody, for an A.R.R.L. relay from Honolulu to Central Europe.

6ZAC says he's ready for traffic for the Orient as soon as the Jap amateurs come to life. Then there's ex-5YH at Peking. Watchasa OM—what's a mere 5000 miles of Pacific Ocean between you and Hawaii? We're waiting for you!

#### British Amateur Recommendations

At a recent conference of the wireless societies of Great Britain the Wireless Society of London was requested to open negotiations with the Post Office Dept. looking to an improvement in amateur recommendations. The society committee made recommendations in substance as follows:

That whereas at present amateurs are permitted to communicate with but five other stations, who are specified in their license, no restriction be imposed upon their communication except that under no circumstances may an amateur make a "CQ" call.

That instead of being confined to a specified two-hour period of operation daily, transmission be authorized for an aggregate total time of two hours per day without specifying hours, except that no uninterrupted transmission shall last longer than 10 minutes.

That amateurs have two wave lengths, one short and one medium; that the 1000 meter wave be abandoned and 400 meters or thereabouts used for C.W. and telephony, with the present 180-meter wave expanded into a band from 180 to 200 or 220, for C.W., telephony or spark.

The committee reminds the Post Office that they have been requested to assist in "maintaining reasonable discipline" and state they are prepared to do so wholeheartedly but "that their task will be lightened considerably if amateurs appreciate that the authorities desire to impose only such restrictions as may be really necessary, and show a willingness to withdraw others that may perhaps seem merely irksome."

The situation, we should say, is encouraging.

#### THE LACKAWANNA EXPERIMENTS

(Concluded from page 34)

Nearly all previous theories on the effect of location on signals were confirmed except that the immediate proximity of rock, steel bridges, and bodies of earth made very little difference. In passing thru thickly wooded sections all long distance signals faded out entirely, while the nearness to a body of water or stream, even tho small, greatly increased the signal strength. In rounding a curve on a perfectly level plain one set of signals would completely fade out and others come in. Aside from the general interest in these experiments, the data obtained may throw a little light as to why some locations are poor or why no signals are received from certain directions.

—B.P.

#### Receivers

By L. Q.

"I CAN work anyone I can hear." The next time anyone springs that remark just take him for a walk to a few small stations that concentrate on receiving and let him conclude for himself, that he has not claimed a good sending set but *admitted* a rotten receiver.

*Moral*—An ostrich also thinks things have quit happening when he puts his head in the sand.



# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



**Y**OUR attention is invited to the outline of the reorganization of the East Gulf, Rocky Mountain, Central, and New England Divisions, particularly as regards your own location if you are situated in any of these divisions.

One of our oldest Division Managers, Mr. G. R. Entwistle, resigned because of business pressure and in his place we have Mr. P. F. Robinson, otherwise known as 1CK.

When Boyd Phelps, former manager of

course with the summer static we believe that C.W. will show a greater percentage

\*\*\*\*\*  
C. W. McCLUNG, 4BF  
515 mags.  
St. Petersburg, Fla.  
East Gulf Division  
\*\*\*\*\*

than spark before Old Man Static "switches off".

## Message Traffic Report By Divisions

APRIL

| Division             | C.W.  |       |        | SPARK |       |        | TOTAL |       |        |
|----------------------|-------|-------|--------|-------|-------|--------|-------|-------|--------|
|                      | Stns. | Mags. | M.P.S. | Stns. | Mags. | M.P.S. | Stns. | Mags. | M.P.S. |
| Central              | 11    | 609   | 55     | 16    | 1693  | 106    | 27    | 2302  | 85     |
| Dakota               | 14    | 580   | 42     | 15    | 1044  | 70     | 29    | 1624  | 69     |
| East Gulf            | 10    | 1233  | 123    | 7     | 296   | 42     | 17    | 1529  | 90     |
| New England          | 9     | 456   |        | 11    | 1007  |        | 20    | 1463  |        |
| Northwestern         | 3     | 60    | 20     | 18    | 504   | 28     | 21    | 564   | 27     |
| Ontario              | 3     | 79    | 27     |       |       |        | 3     | 79    | 27     |
| Pacific              | 14    | 540   | 39     | 17    | 1278  | 81     | 31    | 1818  | 55     |
| Roanoke              | 16    | 420   | 26     | 8     | 180   | 22     | 24    | 600   | 25     |
| Rocky Mountain       | 7     | 348   | 50     | 9     | 281   | 31     | 16    | 629   | 39     |
| Vancouver            | 3     | 22    | 7      | 5     | 62    | 12     | 8     | 84    | 10     |
| West Gulf            | 1     | 23    | 23     | 10    | 483   | 48     | 11    | 506   | 46     |
| Winnipeg             | 1     | 47    | 47     |       |       |        | 1     | 47    | 47     |
| Total                | 92    | 4417  | 48     | 116   | 6828  | 59     | 208   | 11245 | 54     |
| Total Spark—6828—61% |       |       |        |       |       |        |       |       |        |
| Total C.W.—4417—39%  |       |       |        |       |       |        |       |       |        |

the Dakota Division, came to help grind out QST, he left a vacancy which is now filled by N. H. Jensen, new manager of the Dakota Division.

J. A. Gjelhaug has been appointed manager of the Winnipeg Division, and Wm. D. Wood, Jr., has been appointed manager of the Vancouver Division.

A new division has been provided for in Hawaii, known as the "Hawaiian Division" of which Mr. C. J. Dow (of 6ZAC fame) has been appointed manager.

The East Gulf Division carries first honors in individual message traffic, which speaks well for good operating through heavy static.

The April message report shows that C.W. traffic is gaining monthly, and of

## PACIFIC DIVISION

J. V. Wise, Mgr.

C.W. Mags.: 6ZZ-192, 6CU-86, 6AS-81, 6KA-54, 6ASV-44, 6ZB-48, 6EN-42, 6JD-25, 6ALU-17, 6ZX-12, 6AK-4, 6ALA-4, 6KY-3, 6ABX-1. Total, 540.

Spark Mags.: 6VK-317, 6GF-118, 6ZZ-111, 6LC-100, 6AJH-91, 6HP-84, 6AS-80, 6ZD-47, 6AHF-40, 6FH-30, 6OL-19, 6AFP-20, 6GS-16, 6HY-12, 6ALA-3, 6ALU-3, 6ZC-2. Total, 1278.

DISTRICT A: QRM and "flu" have been with us steadily, and now the heat is cutting down distance every day. 6AAH and 6ZD are still doing regular work east and west of Phoenix, Arizona. 6AFP was doing excellent work, but has had to move

ais station. Thus the small amount of traffic from him this month.

Mr. D. G. Chilson has been appointed Assistant District Supt. for Pima, Pinal, Gila, and Navajo counties. He is located at the University of Arizona, which has just been issued the new call 6YB. Mr. Chilson is doing good at his own station 6ASV, tube equipment being used.

DISTRICT B: No reports from any Assistant Superintendents this month, so district "B" still holds its proud position at the head of the wrong end.

DISTRICT C: QRN has hindered a lot of good DX work in this district this month. A few good nights have enabled us to keep the hook clear. The route east is still open via Denver. 6ZZ, or 5ZA. Those able to clear Denver are: 6JD, 6KY, 6EN, all C.W. With the aid of an automobile and force, traffic reports were gathered from nine stations.

Mr. C. F. Filkstead, 6CU, has been appointed Assistant Supt. for Hollywood. He is doing splendid DX on fifteen watts C.W. and is on the job every night.

DISTRICT D: No report from this district. 6ZE, old 6ALE, is being heard quite steadily lately on 200 and 375 meters.

DISTRICT E: 6PJ and 6PR, of Santa Cruz, are under repairs, leaving 6AAU to handle the work, which he has been doing in fine shape. From this district to San Francisco, traffic is handled by 6TU, 6HC, and 6VX, all spark equipment.

DISTRICT F & G: We may note here that the Dist. Supt. Mr. T. B. Brown has moved to 318 Valley St., San Francisco, Cal. 6ALA, of Santa Rosa, has his set working. 6AWT, of San Francisco, is certainly making his lone fifty watter talk for itself. We find the same old gang on the job and doing credit to our A.R.R.L. They are: 6EX, 6HP, 6VK, 6ASJ, 6AWT, 6IM, and 6AS. The manager would like to say that station 6AS deserves a little more credit than he claims for himself. Brown belongs to the order of "Night Owls" and he handles more than his share of the bay traffic. We think 6IM is used to married life now, as we hear him on every evening again.

DISTRICT H: The major part of traffic thru this district has been handled by 6FH, 6GF, 6ABX, and 6IC, with some by 6KM. 6AK has his fone fixed as a C.W. transmitter. 6ZX has canned his old spark for the latest equipment, "the little bottle". It is due to this reason that his traffic report is so short of the average. He is willing to wager that his 20-watt C.W. will put rings on his old rock crusher, if the boys will oscillate their tubes. In this, as in all central districts, the boys work direct north or south every and any evening on both spark and C.W.

DISTRICT I: Mr. Garrett, 6CC, of Colusa, Calif. has just been appointed

District Supt. of this district. Tho no report yet we hear 6TC, 6CC, and 6AIX on the job up there.

DISTRICT J: 6AJR made the report for this district this month. Reno, Nev., still holds her place as working north and south best. Thus a fast route north or south is maintained from the two extreme limits of the coast. The route east to Salt Lake is working well, but still handles less than the others.

### ROANOKE DIVISION W. T. Gravely, Mgr.

C.W. Msgs.: 3IW-110, 3BLF-87, 3BDB-60, 3BZ-54, 3CA-42, 3BHL-36, 3BIJ-31, 8SP-21, 8BPU-20, 4DS-18, 4DC-11, 3RF-10, 4EN-10, 4GH-10, 3MO-6, 3AEV-4. Total, 420.

Spark Msgs.: 8AXY-74, 8WD-29, 4CX-25, 4EA-15, 3AOV-13, 8BAZ-10, 8SP-7, 4DS-7. Total, 180.

Traffic has lagged during the past month due to several causes. Relay operations were checked by broadcasts and listeners, static, and apathy on the part of many operators.

The division is undergoing complete reorganization under the new plan of the Operating Department. The complete personnel including City Managers, District Superintendents, and official relay stations, will be given in next issue. The Assistant Division Managers have been appointed, but as they have not yet perfected the organization in their respective states, no detail will be given out until it is done. However, it is well for all stations located in the division to understand that, in future, the Manager's report will only deal with the live, active, operating stations, so you who are in this category are requested to furnish traffic reports promptly each month. Due credit and mention will be given the individual station doing the active relaying.

Men! Line up in the new permanent organization and give your District Superintendent or City Manager your hearty co-operation when called on.

### NORTHWESTERN DIVISION H. F. Mason, Mgr.

C.W. Msgs.: 7DP-35, 7QB-23, 7BS-2. Total, 60.

Spark Msgs.: 7BK-115, 7HI-64, 7OT-62, 7MP-42, 7LY-38, 7EX-37, 7MU-32, 7BG-27, 7BF-15, 7XB-10, 7IY-20, 7VZ-7, 7ON-7, 7ZU-8, 7NC-6, 7VM-6, 7RM-5, 7DJ-3. Total, 504.

MONTANA: H. E. Cutting, A.D.M., at Libby, reports 7VZ has been making improvements and is now a permanent link in our Northern route east. 7DJ reports Helena coming to the front with four good stations, 7KZ, 7IE, and 7DJ on spark, and 7HW on A.C.W. From Glasgow 7EX reports that sickness and QRN have crippled

the report from that end of the state this month. 7HS is on the job with C.W., and a permanent summer route through the northeastern part of the state is being organized. 7ZU at Billings reports increased activities and is taking traffic on C.W. now. In Bozeman, 7LY is looking around for a second op so that better watches may be stood. 7MP does not know whether to change over to C.W. or not, but reports 9BD of Vancouver, B. C., the most consistent from the north coast, with all California stations QSA. He has worked 9APK of Chicago.

**IDAHO:** In Boise, 7YA on 375 meters and 707 on 200 are both clearing traffic. 7OT is working on schedule with 6QR and 6ASJ. As Moscow, 7JF is reaching out, and 7ZM is still handling traffic in his accustomed style.

#### WASHINGTON:

Ass't Mgr. Reichert has resigned on account of lack of time to carry on the work, consequently we can only give a scanty report until we get someone on the job. Walter Lemrich, 7SC, has been appointed D.S. for Grays Harbor County, and is handling traffic on C.W. He states that he is in a remarkable location for carrying on DX work. 7KJ and 7INN are on with spark and handling quite a bit of traffic. 7HI at Auburn has been doing very consistent relay work. In Seattle,

7BF, 7IY and 7BK cleared most of the traffic for the month. North bound traffic is passed to Canadian 5AK, 5CN, or 9BD every night. Eastern traffic goes through 7VZ at Libby, Mont., or 7GE at Pasco, or 7YA at Boise. Messages for the south are cleared regularly with 6TU, 6VX or a number of other sixes, all of whom are consistently received. Traffic for Portland usually goes through better if routed via Salem, as bad QSS is experienced with Portland direct. 7GE at Pasco is a reliable station that is doing good work.

**OREGON:** Royal Mumford, 7ZJ, A.D.M., reports the following changes in the personnel within the last month: George Cameron, 7DP, has been appointed D.S. for Portland and vicinity; Walter Russ, 7ED, is now City Mgr. for Portland; and P. F. Peyton, 7MU, has been appointed D.S. of Salem and vicinity succeeding 7IJ who is now at sea. All DX stations are encouraged to keep a log of all messages handled, so that we may have complete re-

ports in this respect in the future. 7MU and 7BH are effectively clearing traffic from all directions. From Myrtle Point, D.S. Baker, 7KE, reports a scarcity of stations in his part of the state, but that he has been handling quite a bit of traffic. 7QT is rebuilding at Corvallis 7HF had his transmitter stolen, so is quitting the relay game. This leaves 7IW and 7MF on the job doing good work. D.S. Thibodo, of Seaside, 7HD, states that the same QSS situation exists between there and Portland as exists between Seattle and Portland, viz.: that over a period of about three months in the winter time, Portland stations cannot be heard. Southbound traffic is being routed via 7MF while msgs. for the north should go via the stations 7HI, 7BK, or 7ND. There has been very little

doing for the past few weeks in Portland and vicinity in regard to relay work, as many of our DX stations are either out of commission, or their operators have left for Alaska. 7DP on A.C.C.W. is the star station in Portland this month. 7GJ is on at times. 6ZI reports DP's C.W. as the best in the north. 7DP desires communications from all C.W. stations in Idaho and Montana with a view to making an all-C.W. route east.



#### WEST GULF DIVISION F. M. Corlett, Mgr.

C.W. Msgs.: WRR-23.

Spark Msgs.: 5PE-240, 3QI-64, 5ZH-56, 5MK-46, TC-31, 5EW-15, 5QU-13, 5MJ-8, 5VN-5, 5NG-5. Total, 483.

**NORTH TEXAS SECTION:** For the benefit of those who have not noticed the assignments of territory which have appeared from time to time in QST please write Robert L. Clinkscales, 3913 Hamilton Ave., Dallas, Texas, who will be glad to give you the information as to whom you are to make your monthly report.

Traffic has been moving slowly thru the Northwest District on account of increase in QRN. Old 6ZZ deserves considerable credit for his reliability and the consistency of his spark and C.W. Mr. Gooding has been right on the job and even when he was prevented working spark during the Pacific Coast broadcasts, he worked 5IF

on C.W. for the traffic.

5ABO, is doing some first class receiving at the same time working on his spark transmitter. Traffic has been going through 5IF from 9WI, 5QA, 9DSD, 5IQ, and 5IG very reliably. 9DSD comes through the interference with a boom and is strong and steady. 5TU, has just finished installing a very efficient set, and is being reported all over the country as very QSA. His signals go thru static as if it wasn't there. 5IS, has been doing very little lately except sitting up with OW and watching the stars.

General activities around Waco and vicinity are as good as could be expected, now that QRN is so fierce. Every one seems to fall for receiving sets to listen on 360 meters. 5IQ and 5ZAF continue to hold down the traffic thru Waco, though the traffic fell off during the past month. 5IQ has installed 10 watts of C.W. Conditions this side of Waco proper are improving, with 5LM and 5PP struggling at Temple and 5MK at Ennis.

5QS is going strong. 5EW has installed C.W. 5NC is back strong as ever after having a little trouble with his sink gap. 5JG just completed his 30 watt C.W. 5PE has been doing some fine work on  $\frac{1}{2}$  K.W., and has worked stations in every district except the 7th.

**SOUTHERN TEXAS SECTION:** Spark sets are getting more and more scarce with each report from this section, 5YG, 5BA, and 5JI being the only DX spark stations now operating in these parts. Splendid results are being obtained with C.W. and fones at 5NK, 5NN, 5PO, 5ZX, 5JM, 5CA, 5PB, 5ZV, and 5YG.

All traffic from San Antonio district is suffering from strong harmonics from the high-powered army station there. 5ZAK has moved his set to Kelly Field and united with GP4, which assures us of a wonderfully efficient relay station. The Radio Inspector has been in San Antonio conducting exams. and visiting installations under the guidance of Mr. Wall, 5ZAE, A.R.R.L. representative for that city. Traffic for San Antonio district totalled 66 messages, and for the Laredo district, 27 messages.

5MT continues to be the busiest station, and is daily assisting the State Dept. of Markets by supplying the 5XU broadcast station with information regarding shipments from the valley. 5UF is the only spark station in operation. 5ZAN continues to operate with a splendid C.W. and fone set. 5ZN is to be congratulated upon his continued effort to discharge his duties as D.st. Supt. with the many handicaps he has met with this season.

**OKLAHOMA:** Sparks are all getting scared out by the static. 5BR, 5LO, 5BM, 5FO, and 5HK are installing C.W. and making preparations in general to battle

QRN. Dist. Supt. Whartenby of Enid is planning a large fone set. Messages reported from his district total only 14 on account of the QRN.

In the eastern part of the state 5BM is going to keep traffic moving with his new 50 watt C.W. BM worked 4GL and "gobs" of 5's and 9's the first nite the set was completed. F. B.!

5AQ, is a very consistent station. W. H. England is opening up with a 100 watt C.W. which surely sounds like business to us. This makes several good relay stations in northern Oklahoma.

### WINNIPEG DIVISION

J. A. Gjølhaug, Mgr.

C.W. Msgs.: 4CB-47.

More good relay stations are needed, especially between Winnipeg and Regina, about in Brandon, Man., that would help greatly to span the long jump west from Winnipeg.

4CB has been doing fine work with his 15-watt C.W. this month, having handled considerable U.S. east and west bound traffic when spark stations could not connect up very well. 4EI of Moose Jaw, Sask., is a new 5-watt C.W. station. 4BG reports very little doing in traffic work this month.

To all A.R.R.L. stations in the Winnipeg Division: Please get in touch with your Dist. Supt. if you have not done so already, and give him a brief report about the 15th of each month of what you are doing in relay work, what stations you work with, how many messages handled during the month ending the 15th, etc. This will help greatly in laying out routes and getting a line-up of things in general. By doing this you are not only helping the whole A.R. R.L., but also helping yourselves. "Blow your own horn"—there is nobody that can come and blow it for you. A brief report of this nature will go nicely on a post card and would only take you a few minutes to write. If you could arrange morning schedules with each other you will find that this is the best time in summer. Try it and you will be surprised.

### ALASKAN DIVISION

Roy Anderson, Mgr.

A. A. McCue's much talked of 20-watt C.W. set was never installed and we are sorry to inform those who follow our activity that Mr. McCue has left for a more southern climate.

While experimenting with a Westinghouse tuner at 7IT, the following amateur calls were heard, using 2-steps and small aerial, April 5th or 6th: 7BK, 7GE, 7NN, C18 (who is he?), 9BD and 7OH. All were QSA in spite of local interference and the fact that the "J's" insisted on seeking our 200 wave.



Fellows, we want to get something lined up. Let's hear from a bunch of you. What kind of sets have you? How many miles is it good for? What hours could you keep? What people in your district have radio sets? What kind? Address?

You know that there are hundreds of fellows in the states who follow our progress (?) so let's go!

### ROCKY MOUNTAIN DIVISION

M. S. Andelin, Mgr.

C.W. Msgs.: 9XAQ-98, 6ZA-65, 9ZAF-61, 9AMB-40, 9DVA-39, 6ZAM-30, 7ZO-15. Total, 348.

Spark Msgs.: 6AFD-64, 6ZAM-57, 7OS-30, 6ZAJ-26, 7ZO-25, 6ATH-23, 7ZV-21, 6BKE-18, 6AWH-17. Total, 281.

We have in this division at present several good relay stations that are in operation and handling traffic continuously. Several also have closed down for the summer on account of QRN. We have an all-summer route in operation and intend to keep it going all summer. The relays are accomplished in short jumps and most of the stations are capable of daylight communication with each other. Most of the traffic has gone across the division by two routes, 7ZO at the north and 6ZA and 6ZAM alternating at the south.

The division has undergone complete reorganization according to the plan set forth by the Traffic Manager and all members of the division are requested to give their best support and co-operation to their respective superintendents.

The appointments made so far in the reorganization are as follows: *Wyoming*, Norman R. Hood, 1022 So. Ash St., Casper, Wyoming, Executive Assistant and Assistant Division Manager; *Utah*, Glen Garner, 583 26th St., Ogden, Utah, Assistant Division Manager; Ralph Baker, Supt. for District #1, which includes the northern part of Utah; Evan Seegmiller, Supt. for District #2, which includes southern Utah.

### VANCOUVER DIVISION

W. D. Wood, Mgr.

C.W. Msgs.: 9BD-13, 5CT-6, 5BI-3. Total, 22.

Spark Msgs.: 9BD-32, 5CN-12, 5AK-9, 5FE-5, 5DO-4. Total, 62.

In the reorganization of this division the following appointments have been made: Assistant Division Manager, R. M. Ellis, 5BI, North Vancouver, B. C.; District Superintendents: Prince Rupert District, J. Barnaley, 5AX; Cloverdale District, R. M. Balfe, 5AD; Chase District, H. V. Weaver, 5ET.

Appointments have yet to be made in the following districts: Vancouver Island—Victoria man wanted for this job: QSL pcc. Kootenay District—Need a live wire

up that way. Edmonton District—The Manager is sadly in need of news from there. Calgary District—Same applies as to Edmonton.

J. T. North, Jr., 5AK, has been appointed City Mgr. for Vancouver, and N. Goode, 5FE, is our City Mgr. for New Westminster. 5CN and 9BD, have less trouble handling traffic with 6's in California than with nearby stations such as 7BK and others in Puget Sound.

Notices have been sent out by the Dept. of the Naval Service Radiotelegraph Branch, Ottawa, that all amateurs in the Dominion of Canada are now allowed 180 meters for spark work and 200 meters for C.W. Experimental stations will continue to have "S" calls and are now allowed 200 for spark and up to 275 for C.W. Amateurs in this Division should write to Mr. E. J. Haughton, Div. Supt., Victoria Branch Office, for any particulars.

C.W. signals are traveling upwards to the northwest in great style this time of year, but there are none to be compared with 6ZI of Oakland, Cal.

6ZAC of Hawaii is QRK here and 9BD is ditto in Maui. 5CN, 5CD, 5CZ and 5AD will soon be on the air with small C.W. sets. 4CB is always QRK in Vancouver and we work him pretty regularly. We Canucks are all pulling strong for a Trans-Canada relay route. It looks like a goner until next fall, but we shouldn't give up the ship too soon for everyone knows "CW DUZIT."

### EAST GULF DIVISION

B. W. Benning, Mgr.

C.W. Msgs.: 4BF-515, 4GL-300, 4BY-183, 4II-96, 4IZ-47, 4YA-30, 4IW-25, 4EH-20, 4KU-14, 480-3. Total, 1233.

Spark Msgs.: 4BI-180, 4EZ-62, 4HS-55, 4KO-17, 4JZ-12, 4BC-12, 4DZ-5. Total, 296.

Under the new Operating Department scheme the following appointments have been made: W. B. Pope, Assistant Division Manager, Georgia; V. C. McIlvaine, Assistant Division Manager, Alabama; M. F. Harrod, Assistant Division Manager, Florida; W. C. Etheredge, Assistant Division Manager, South Carolina.

This month marks the appearance of the "East Gulf Radiogram", a magazine with the express purpose of promoting the radio interests in the south. The growing popularity of all forms of radio has made it imperative that such a magazine be published in this part of the country or we will have the alternative of being overwhelmed by the more numerous "listeners." This Division needed a publication to assist in developing its organization into an efficient, trouble-proof, and co-operative unit more capable of handling relay traffic.

FLORIDA: In accordance with the new Operating Department changes we now

• have the state divided into four districts as follows:

Northern Florida, District #1,  
M. D. Clarke, Dist. Supt.  
Central Florida, District #2,  
E. R. Hall, Dist. Supt.  
Southwestern Florida, District #3,  
W. E. Wood, Dist. Supt.  
Southeastern Florida, District #4,  
F. M. Gookwalter, Dist. Supt.

Although our mighty friend Static has started with the preliminary bout we are doing our best to stay on the job. In District #1, 4ZE has succeeded in connecting with 4FD and 4GN regularly and this has proven to be a reliable short-jump relay. In District #2 we have some of the larger cities of Florida including Orlando, St. Petersburg, Ocala and Tampa. There are good prospects for relay material in this district. Both 4II and 4BF are "knocking em loose" on C.W. 4BF is the star DX station of Florida having worked 6KA on several occasions and handled traffic with him. This station has been appointed City Manager of St. Petersburg and the operators there are doing their best to establish a real relay center. 4KD and 4JZ on spark, and 4IZ on C.W., are handling traffic. 4BH (C.W.) has just started active work. This is District #3. In District #4, both 4BC and 4DZ are doing good work on spark, 4BC and 4EZ from a dependable route to the east coast.

**SOUTH CAROLINA:** Not a DX station in operation. Everyone seems to be interested in listening only.

**GEORGIA:** 4BY and 4GL are still "knocking about". Both sets were reported heard by ship 300 miles off the English coast. This is exceptional summer work, even for C.W. In Atlanta, most of the messages were handled by spark, due to the fact that 4FT is now the broadcasting station of the Atlanta Constitution. 4EH, 4CO, 4KU, and 4YA, have handled a few messages with their low powered C.W. sets. On spark, 4BI and 4HS take the highest honors. 4GM has combined sets with 4BI. 4AU has dismantled and will not be on again until next fall.

#### DAKOTA DIVISION N. H. Jensen, Mgr.

C.W. Msgs: 9WU-185, 9BBF-78, 9AEJ-60, Twin Cities-58, 9AWM-49, 9AAO-40, 9AFQ-28, 9AUU-20, 9YAJ-20, 9AOR-12, 9PI-12, 9BMO-9, 9EA-7, 9BKP-5. Total 580.

Spark Msgs: 9AIG-265, 9YAJ-129, 9LW-125, Twin Cities-87, 9AGN-80, 9DOC-75, 9FX-60, 9AVZ-55, 9BRI-40, 9BAF-30, 9ZC-28, 9TI-20, 9AYW-19, 9BOF-16, 9EE-15. Total 1044.

**NORTHERN MINNESOTA:** Stations handling traffic in this District are 9ZC,

9EA, 9BAF and 9AOR. Plans are being made for summer routes.

**SOUTHERN MINNESOTA:** 9XI has succeeded in getting an appropriation thru for a big phone set. Mr. Carpenter is active in getting summer routes organized for short jumps leading into Minneapolis. The amateurs of Southern Minnesota met in Convention at Sleepy Eye a short time ago, and formed the Radio Association of Southern Minnesota. Officers were elected and plans made for organization. Mr. E. T. Sperling, 9BBF, New Ulm, was elected Traffic Manager, and an operating schedule was drawn up. Most of the amateurs attending were from the southwestern part of the State. There appears to be very little doing in the southeastern part. The stations most active in the District are: 9YAJ, 9BBF, 9AWM. Daylight routes are being started. 9YAJ operates from 4 to 6 P.M., daily.

**NORTH DAKOTA:** 9WU has consistently worked all three coasts and every District, both Canadian and U. S., on 50 watts. There are a number of good relay stations in the district, the leaders of which are: 9WU, 9LW, 9AGN, 9DOC, 9AEJ and 9FX.

**SOUTH DAKOTA:** A new station in this district that has been doing good work is 9BRI at Winner. Since 9YAK has been out of commission, 9AIG has taken the lead in traffic work. 9AVZ is another good relay station, having no trouble in working west. In the northern part of the district 9PI, 9AKX and 9TI are leaders.

#### ONTARIO DIVISION A. H. K. Russell, Mgr.

C.W. Msgs: 9AL-49, 3JI-26, 3JK-4. Total 79.

April is the start of a new year in radio for Canadian amateurs, as on April 1st all licenses have to be renewed. And with the renewal of licenses this year the axe has fallen. The new regulations have apparently come into force which are substantially as follows: spark, 180 meters; general amateur, C.W., 200 meters; and special amateurs, 275 meters on C.W. and 200 meters on spark. This results in a very substantial improvement in amateur conditions in Canada, and the Naval Dept. is to be congratulated on its decisions. The department also has adopted a scheme which could well be followed in the United States of licensing broadcasting stations for waves ten meters apart, to avoid the conflicting waves which at present are heard at all times from American broadcasting stations.

From District No. 1, we hear that Byerlay and Mackay are going great. The former is also getting C.W. going. Gowan in Kitchener was heard one night only on C.W. but not since.

Toronto district is still going C.W. Sta-

tion after station is changing over, and several of the new C.W. stations have done fine work, especially 3JL.

Donnelly in Kingston reports that the broadcasting has cut into relay work badly. 3IL in Kingston recently copied the 20 watt C.W. station 6ZB. Brockville seems to be dead to radio, but Staebler and Sinclair in Gananoque are livening up their town.

#### CENTRAL DIVISION

R. H. G. Mathews, Mgr.

C.W. Msgs: 8VY-245, 8BFH-91, 9AZE-63, 8BXX-60, 9UW-46, 8BEX-40, 9GU-21, 9ACE-20, 9AVO-15, 9AQG-6, 8BFI-2. Total 609.

Spark Msgs: 9ZI-356, 8FT-332, 8ZO-250, Mich.-188, 8UC-136, 9ME-157, 9AJH-60, 8AHY-48, 9YB-47, 8AIZ-36, 8AFS-26, 8BFI-19, 8AFH-17, 8BSI-18, 8BEX-4, 9AWU-4. Total 1693.

With April has come the start of the reorganization of the Operating Department in this Division. All outstanding appointments have been cancelled in accordance with the orders of the Traffic Manager, and appointment certificates recalled. New certificates both for appointments in the department and for appointment as official relay stations will be issued as fast as appointments can be made.

The following have been appointed under the new reorganization plan:

OHIO: Mrs. C. Candler, 8ZL, 105 S. Ash St., St. Mary's, Ohio, Assistant Division Manager.

District No. 1 consists of the following counties: Williams, Defiance, Paulding, Van Wert, Mercer, Fulton, Henry, Putnam, Allen, Auglaize, Lucas, Wood, Hancock, Hardin and Logan. Superintendent, K. A. Duerk, 8ZY, 1000 Wilhelm St., Defiance, Ohio.

District No. 2 consists of the following counties: Ottawa, Sandusky, Seneca, Wyandot, Marion, Morrow, Crawford, Erie, Huron, Richland, Knox, Lorain, Ashland, Medina and Wayne. Superintendent, J. P. Turner, 681 George St., Clyde, Ohio.

District No. 3 consists of the following counties: Cuyahoga, Summit, Lake, Geauga, Portage, Ashtabula, Trumbull and Mahoning. Superintendent, Paul A. Marsal, 1527 Lakeland Ave., Lakewood, Ohio.

District No. 4 consists of the following counties: Darke, Preble, Butler, Hamilton, Shelby, Miami, Montgomery, Warren, Claremont, Champaign, Clarke, Greene, Clinton, Brown, Madison and Fayette. Superintendent, L. E. Furrow, 8FT, Troy, Ohio.

District No. 5 consists of the following counties: Delaware, Franklin, Pickaway, Union, Ross, Highland, Adams, Scioto, Pike, Ross, Licking, Fairfield, Perry, Hocking, Athens, Vinton, Jackson, Meigs, Gallia and Lawrence. Superintendent, M. F. McDowell, 8EC, 612 Mithoff St., Columbus, Ohio.

District No. 6 consists of the following counties: Holmes, Coshocton, Muskingum, Morgan, Washington, Noble, Guernsey, Tuscarawas, Stark, Columbiana, Carroll, Harrison, Jefferson, Belmont and Monroe. Superintendent R. D. McCommon, East Palestine, Ohio.

WISCONSIN: Ben A. Ott, 9ZY, La Crosse, Wisc., Assistant Division Mgr.

District No. 1 consists of that part of Wisconsin bounded on the east by Lake Michigan, on the north by a straight line drawn from Portage to Port Washington and on the west and south by a straight line drawn from Portage to the junction of Wisconsin and Illinois on the shore of the lake. Superintendent, C. N. Crapo, 1175 2nd St., 9VD, Milwaukee, Wisc.

District No. 2 consists of that part of Wisconsin bounded on the east by a line drawn from Portage to the junction of Wisconsin and Illinois on the lake, on the north by the Wisconsin River on the west by the Mississippi river and on the south by the state line. Superintendent, K. C. Maas, 9AZA, Whitewater, Wisc.

District No. 3 consists of that part of Wisconsin bounded on the east by the eastern state line, on the south by a line drawn from Portage to Port Washington, on the north by the state line and on the west by a straight line drawn from Portage through Wausau to the north state line. Superintendent, J. Kraus, 9ACM, Sheboygan, Wisc.

District No. 4 consists of that part of the state bounded on the north by a straight line drawn from Wausau to Hudson, Wisc., on the east by the Wisconsin River and a straight line drawn from Portage to Wausau, on the south by the Wisconsin River, and on the west by the Mississippi or state line. Superintendent, Robert White, 9AEH, La Crosse, Wisc.

District No. 5 consists of that part of the state bounded on the east by a straight line drawn from Wausau to the northern boundary of the state, or in other words the western boundary of District No. 3, on the south by a straight line drawn from Wausau to Hudson, Wisconsin: on the west by the state line and on the north by the state line. Superintendent, E. J. Krusel, 9YAC, Superior, Wisconsin.

MICHIGAN: C. E. Darr, 137 Hill Ave., Highland Park, Detroit, Mich., Assistant Division Manager.

District No. 1—Superintendent, F. D. Fallain, 8AND, 104 Wash Bldg., Flint, Mich. District No. 2—Superintendent, M. H. Pancost, 8ZF, 1101 Climax Ave., Lansing, Mich. District No. 3—Superintendent, A. T. Shirrine, 8JZ, Holland, Michigan. City Manager of Detroit, E. G. Boyes, 611 W. Willis St., Detroit, Mich.

NORTHERN INDIANA: M. W. Hutch-

(Continued on page 05)

# Who's Who in AMATEUR WIRELESS



**T**HERE may be some member of the A.R.R.L. who has not yet met Hiram Percy Maxim, the "Old Chief", president of the American Radio Relay League.

For once in our young life we wish that

we could write—write fluently and have that knack of picking up adjectives and adverbs that would make it possible for us to do a good job in speaking of H. P. Maxim. Because we have so cordially detested flowery writing as applied to the preparation of a magazine such as our QST, however, we haven't a trace of beauty left in our style and are afraid we're out of luck. We can only say that here is a *man*—a real man's man—if God ever made one!

Mr. Maxim, son of Sir Hiram Maxim, noted inventor of automatic firearms, was born in Brooklyn, Sept. 2, 1869, educated at Massachusetts Institute of Technology, and has been identified with electrical manufacturing since its early days. His business connections have been successively with the Thomson Electric Welding Co., Lynn, Mass., American Projectile Co., one of their subsidiaries; Pope Mfg. Co., Hartford, Electric Vehicle Co.; Westinghouse Electric & Mfg. Co., East Pittsburgh, and finally the Maxim Silencer Co., of Hartford. Mr. Maxim was one of the earliest automotive engineers in this country—a pioneer in the automobile game.

He was pushed into radio by his son Hamilton in 1910 and mastered the code

at the age of forty. Thus he has watched the development of radio thru the eyes of a man of mature judgment. In those early days, of course, initials were used for call letters and one's wave length was anything

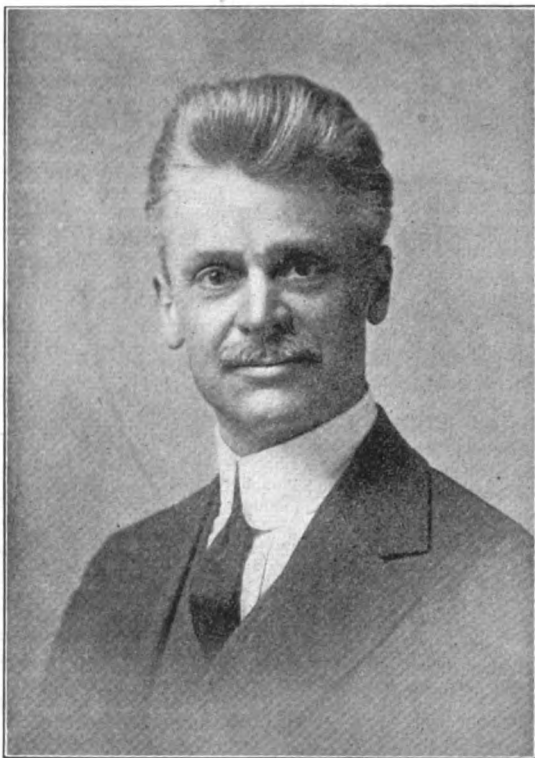
that passing fancy dictated. He was among the early ones to take out a license when the law of 1912 was enacted, and for some years before the big war was 1ZM in Hartford. After the war he became 1AW and has stuck to it ever since.

Mr. Maxim is prominently identified in many lines of activity. He is president of the Aero Club of Hartford, former chairman of the Hartford branch of the American Society of Mechanical Engineers, president of the Technology Club of Hartford, a member of the Executive Committee of the M.I.T. Alumni, a consulting mechanical engineer—active in many lines. His chosen field is *sound*, on which he is a national authority, his studies into this field

having resulted in the invention of the Maxim silencer, not only familiar on rifles but finding multitudinous applications in industry, or motor-driven vessels, etc.

Of all of Mr. Maxim's many affiliations, however, we believe he is proudest of his connection with our A.R.R.L. It was he who first conceived a national society of amateurs devoted to relaying and who started the ball rolling. From the very first he has fathered the A.R.R.L., guided its des-

(Concluded on page 50)



HIRAM PERCY MAXIM



**C**LUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

#### Wisconsin's First Annual Radio Show and A. R. R. L. Convention

The Milwaukee Amateurs' Radio Club is holding Wisconsin's first annual A.R.R.L. Convention in conjunction with the Radio Show to be held at the Milwaukee Auditorium June 21st to 25th inclusive.

The Radio Show is under the direction of Mr. Spearman Lewis of the Chicago Opera Company. The convention call has been issued on authority of Mr. Ben A. Ott, District Superintendent of A.R.R.L. for Wisconsin. The convention is under the direction of C. N. Crapo, Milwaukee, City Manager for the League.

The convention is to be held in Plankinton Hall at the Milwaukee Auditorium and will be open to the general public. Distinguished speakers from radio centers have been assured. Pre-convention headquarters will be open at the Hotel Plankinton, where an information bureau will be maintained. Up-state members who anticipate attending are requested to communicate forthwith with Herbert F. Wareing, Chairman of Reservations.

The following Committees have been appointed:

|                            |                  |
|----------------------------|------------------|
| <i>Convention Director</i> | C. N. Crapo      |
| <i>Program</i>             | L. S. Baird      |
| <i>Reservations</i>        | H. F. Wareing    |
| <i>Banquet</i>             | E. W. Ruppenthal |
| <i>Entertainment</i>       | D. W. Gellerup   |
| <i>Publicity</i>           | A. J. Simandl    |

**Wednesday**—Show Day, reception, and registration of men. Visits to prominent stations.

**Thursday**—Opening day of Convention. Reception. Tours of city. 7 P.M. Formal opening of Convention by League representatives and city officials followed by non-technical lectures.

**Friday**—1 P.M. Traffic meeting, District of Wisconsin. All A.R.R.L. men requested to be present. 4 P.M. Technical and popular lectures. 7 P.M. Technical lectures.

**Saturday**—Afternoon, special features to be announced later. 8 P.M. Banquet.

#### The Women's Radio League of America

The women's Radio League of America, Inc., held its first Annual Meeting on Tuesday evening, May second, in Room 907 Y.W.C.A. Building, 53rd Street and Lexington Ave., New York.

The following officers were elected:

|                       |                       |
|-----------------------|-----------------------|
| <i>President</i>      | Miss Abbie Morrison   |
| <i>Vice-President</i> | Mrs. Eleanor G. Regan |
| <i>Secretary</i>      | Mrs. J. Koch          |
| <i>Treasurer</i>      | Miss Elizabeth Rhodes |

The regular meetings of the League are held on the first and third Tuesday evenings of every month at the above address. Code practice for those who wish it is at 8 P.M., business meetings at 8:30 and the speaker of the evening at 9:00.

At the meeting on May 16th, Mr. A. A. Hebert, Treasurer and a director of the American Radio Relay League and Vice-Pres. of the Second District Executive Council, spoke on "Co-operation and Organization."

All women interested in radio are invited to attend these meetings, and if desired courses in radio telegraphy or telephony can be arranged for.

#### Dallas Radio Club

U.S. Radio Inspector Theodore G. Deiler, from New Orleans, visited several North Texas cities on a recent tour of inspection. Amateur examinations were conducted in Dallas on Tuesday April 18th, and commercial examinations Wednesday April 19th. An informal dinner in honor of Mr. Deiler was given by members of the Dallas Radio Club, officers and directors. Mr. Deiler visited Ft. Worth, Austin, Houston and San Antonio.

#### Scenic Highway Radio Club

A mass meeting of most of the radio men of the city was held here Tuesday, March 21st. Meeting was called to order by the President of the Scenic Highway Radio Club and then discussions took place by the leading radio amateurs of the city as to the proper method to be adopted con-

cerning broadcasting. No agreement could be reached on the subject of regulating the wave of radiophone broadcasting stations. Many were of the opinion that the waves from 600 to 1000 meters should be set aside for this specific purpose but no agreement could be reached. So we took up the discussion of sending during the broadcasting of concerts.

Many arguments were advanced as to why spark transmission should be allowed during the evening but all of these were promptly refuted by the members. Finally hours were decided upon for the listening in on broadcasting stations. These were from 6 to 10 p.m. In the evening no amateur in the city of Clinton shall send out any form of message by either spark or CW transmission, nor shall any testing whatever take place during these hours. This was put to a vote and every one was unanimously agreed on this form of regulation.

As yet we have had little interference, practically none, and we feel assured that if the Radio Clubs in other cities would get together on this proposition we would be assured of hearing radiophone concerts without any interference at all.

#### **Philadelphia Amateur Radio Association**

The Philadelphia Amateur Radio Association held its last regular meeting in the Widener Memorial Library at 1200 North Broad St. on Monday April 3, 1922. Mr. W. C. McFadden who is from the Laboratory of the Phila. Navy Yard gave a talk on Radio Frequency Amplification and discussed the subject fully. The subject was very interesting to all the amateurs as they have been experimenting on it.

Mr. Chas. VanDerVera gave a short talk on "Practical Experiments with Audio Frequency" which was very interesting. Information and prices were given by the President on "Condensite Celeron." Mr. John Delp, Jr., talked on "New Circuits for using Audio Frequency" and a discussion followed.

The President decided that on account of the hot weather the next meeting would be the last, until the third Monday in September.

#### **Cleveland Radio Association**

The Cleveland Radio Association has come out with a very neatly printed card giving their recently adopted traffic regulation which we can recommend to other clubs judging from the results that has been secured in Cleveland. Any clubs interested in obtaining a copy of these regulations may secure them from P. A. Marsal, Cleveland City Manager, 1527 Lakeland Ave., Lakewood, Ohio.

#### **The Delaware (Ohio) Radio Association**

has two traffic stations, 8AJX and 8AJE, which aided in sending out the football and basketball scores for the high school and Ohio Wesleyan University. The scores of football games were sent out by 8YK using a relay on the football field.

At a meeting of the Philadelphia Amateur Radio Association, held on January 16th, E. B. Meyers of Jersey City read a paper on "Vacuum Development from 1884 to 1922." C. A. Service, vice president of the A. R. R. L., spoke in the interest of the 3rd and 4th districts convention. Because of the large attendance, many members had to stand during the lectures. This club is growing splendidly and doing good work in its territory.

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#### **H. P. MAXIM**

*(Concluded from page 48)*

tiny, presided at the deliberations of its Board, represented it at Washington—given freely of his time and energy. His kindly counsel and mature advice have been the biggest factors in the building of our League.

Hiram Percy Maxim is a prince!

—K.B.W.

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#### **OPERATING DEPARTMENT**

*(Continued from page 47)*

inson, 9HR, Middlebury, Ind. Assistant Division Manager.

District No. 1 consists of all territory in District of Northern Indiana east of a north and south line drawn through South Bend, including South Bend. Superintendent, E. E. Pippinger, 9FS, 806 S. 7th St., Goshen, Ind.

District No. 2 consists of all territory in the District of Northern Indiana west of north and south line drawn through South Bend. Superintendent, J. Ralston Miller, 9CP, 854 Calumet Ave., Hammond, Ind. South Bend City Manager, F. S. Libbe, 9DAK, South Bend, Ind. Fort Wayne City Manager, L. S. Slagle, 9ME, 530 Masterson Ave., Ft. Wayne, Ind.

This is probably the last report of the Miami Valley District under the old organization. Activities in this district seem to have diminished considerably during the past month, due, on doubt, to the heavy static that has appeared. Some of the stations also have had operating troubles in the way of burned out tubes, condenser and gap troubles. It is interesting to note that only two stations had any C.W. traffic to report. This is not necessarily an indication that the C.W. stations were not able

*(Concluded on page 57)*

# With Our Radiophone LISTENERS



## LIGHTNING PROTECTION

This summer we have about twenty times as many aerals in this country as last and with the first clap of thunder christening the launching of the static season, we hear the cry from thousands of householders, "How much danger is there from lightning striking my house?"

These same houses have stood many summers full of light wires, door bells, gas and water pipes, tin roofs, gutters, down spouts, and other metal objects. The average antenna differs little from these so it is not any more probable that lightning will strike this summer than last. Some while ago QST asked for information on cases of direct hits on aerals and only two cases it seems are on record.

Damage by lightning is either caused by a direct hit or by heavy currents induced by a flash of lightning between two clouds or between cloud and earth. Direct hits are always too violent to be protected against as the heaviest cables and switches invariably melt. The lightning flash seems to abide by no set rules, often following unreasonable paths. The National Fire Protection Association is realizing these facts in changing the requirements for ground wires from No. 4 to No. 6 B. & S. copper, and now has a tentative revision that only requires No. 14 copper wire or No. 17 copper-clad steel.

Heavy induced currents are not nearly so rare and are the only ones that protection can be secured against. The electric discharges known as lightning are the result of a gradual collection of a charge on a cloud as it forms and moves across the country. The charges can be gradually and silently removed by grounded

lightning rods, aerals, steel buildings, etc. Receiving aerals should be grounded at all times when not in use by a lightning arrester having a short air gap. The arrester type is preferable for a receiving station as it does not rely on the memory of the operator. The air gap should be short enough to break down at a potential of 500 volts or less. The vacuum type has the additional advantages of being free from moisture and a less possibility of the electrodes fusing together because of the greater separation in a vacuum for the same break-down voltage.

The new regulations will not go into effect before fall. However certain points in installation should be closely adhered to. The lead-in wires should not be smaller than No. 14 B. & S. gauge copper or No. 17 copper-clad steel. The protective device should be located as near as possible to the point where the wire enters the building and not near any easily ignitable stuff or inflammable gases or combustible dust. The ground wire can be bare or insulated, not smaller than that required for the lead-in, and should be run in as straight a line as possible to a good permanent ground such as water piping. Gas piping is not permissible but other grounds such as steel frames of buildings, driven pipes, buried plates, cones, etc., are OK. The ground wire should be protected against mechanical injury and approved ground clamps used.

With the above precautions it is doubtful if your house is in any way more liable to be bothered by lightning this summer than in any past summers. —B.P.

In February 1921 the Dallas Radio Club

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Since we published the list in our last issue of licenses granted to broadcast stations, several new QRA's have come to our attention which may be added. They are:

|                              |                    |      |
|------------------------------|--------------------|------|
| City of Dallas,              | Dallas, Texas      | WRR  |
| McCarthy Bros. & Ford,       | Buffalo, N. Y.     | WWH  |
| K & L Electric Co.,          | McKeesport, Pa.    | WIK  |
| Doubleday-Hill Electric Co., | Washington, D. C.  | WMU  |
| Atlantic Journal,            | Atlanta, Ga.       | WSB  |
| Findley Electric Co.,        | Minneapolis, Minn. | WCE  |
| Minneapolis Journal,         | Minneapolis, Minn. | WBAD |
| Minneapolis Tribune,         | Minneapolis, Minn. | WAAL |
| Commonwealth Electric Co.,   | St. Paul, Minn.    | WAAH |

appointed the station of their president, Mr. F. M. Corlett, 5ZC, as broadcasting station for the Weather Bureau and Police Department. An efficient organization was worked up for delivering the reports thru the stations of the A.R.R.L. members. The following July the city purchased a phone set from a local club member and now under the call WRR the weather forecasts and police reports are sent out on telegraph and phone on 485 meters at noon and 7 p.m. (C.S.T.) followed by entertainment of various kinds for retaliation. WRR has been heard over a good portion of the country with a set of low power which seems to have a steady daylight summer range of 200 miles on phone and of course much further on C.W.

#### Long-Distance Therapeutics

Nowadays the surgeon on duty on the high seas not only cares for the ills of the passengers and crew of his own ship but often is called upon to give aid to other vessels within the wireless call.

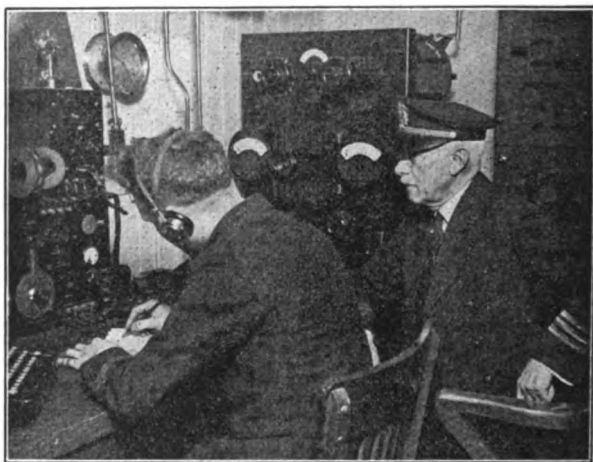
Dr. Michael Rebert, who appears in the photograph, recently was aroused late one night by the wireless operator on his vessel and informed that twelve members of the crew of a Norwegian freighter were in terrible agony and desired medical attention. Dr. Rebert inquired as to the history of the ailment and found the crew had partaken rather forcibly of canned lobster. He diagnosed the case as ptomaine poisoning. When the twelve sufferers had finished the doctor's directions they had exhausted their entire supply of Rochelle Salts and reported progress at dawn.

Recently Dr. W. S. Ford, of the Steamship "Potomac", aided and abetted the stork by wireless. Late one night he received this message: "Captain's wife on board. Expect arrival of stork before we can reach port. Please assist." This was a stumper but the doughty doctor could not fail in this emergency, so he gave the directions in language that could be understood by the layman, while the stork hovered over the distant freighter. Two days later the doctor received this message: "Now have a new son. Don't know your name, doctor, but will call him Napoleon Ford. A thousand thanks. God bless you."

Dr. William S. Irwin when surgeon on the Steamship "Centennial State" was summoned to the wireless room one day and informed that the lighthouse keeper on a lonely island in the Caribbean was suffering as a result of an injury to his leg. Further details showed that gangrene had set in and that amputation was necessary

immediately. Across the 800 miles of sea it was asked if any of the four other inhabitants of the island would attempt the operation if provided with specific directions. The surgical operation was performed by the cook using a butcher knife and a kitchen saw. Inasmuch as no anaesthetics were available, the injured man had to grin and bear it, but fainted before the operation was concluded. During the following days the doctor was kept informed that the patient was doing well, as he had a robust constitution. Several months later in passing the island he learned that his patient was well on the road to recovery.

Only a few weeks ago the doctor and patient met for the first time when the one-legged man grasped his hand at the pier in New York and said, "Doctor, you don't know me but you ought to inasmuch as you are responsible for taking off my leg." Then followed a rehashing of the historic case.



#### Directions for a Very Simple Set

Letter Circular 43 of the Bureau of Standards described a simple home-made radio receiving set using a crystal detector. This set was of the simplest possible construction and could be made by any amateur for a very moderate price, probably under \$10. The demand for this circular was so great that it was decided to print it as a regular publication of the Bureau of Standards, and it is now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c per copy. Persons writing for this material should refer to Circular 120 of the Bureau of Standards.

May 10th marked the close of a contest conducted by the Standard Furniture Co. of Seattle, for the best home made re-



ceiving set tuning from 100 to 500 meters. The entries were made in various classes according to whether amplifier units were included, left out, or just crystal detectors used. There was also a separate class for boys and girls under 14 years of age, and a fifth class for the smallest crystal set. Two cash prizes of \$25 and \$15 were given in each class but the first in which the prizes were \$50 and \$25. The sets were actually tested on the broadcast of KFC using the same tubes and aerial in each test.

### Getting Started Listening (Continued from March)

Having settled the question of the aerial and ground, we are ready for a discussion of the apparatus. It is difficult to recommend specific apparatus as there are so many combinations ranging from simple sets made at home for a few dollars to elaborate ones found on the market at good stiff figures. Simple crystal outfits bring in the broadcasts over limited distances, but in general they are toys and not to be recommended unless one lives within a few miles of a powerful broadcasting station. So we are discussing here the sets using vacuum tubes—the only really practical sets at present.

We will need:

- (1) A tuning set or "receiver" of some sort
- (2) Vacuum tube equipment consisting of a detector and if possible one or two stages of audio-frequency amplification
- (3) A storage battery to heat the filaments of the tubes
- (4) A high-voltage dry battery for the "anode circuits" of the tubes
- (5) A pair of telephones, commonly called a "head-set", and
- (6) A "loud-speaker" or horn, so that the signals may be heard thruout a room without head-sets.

The best way to discuss these necessary items in the set is to take them up briefly in turn.

The tuner is the apparatus that is used to adjust to the various wave lengths and makes it possible to pick up any desired station within range. It consists of various electrical circuits of coils and condensers capable of adjustment in their electrical dimensions, which determine the wave length to which the set will respond. Some tuners are simple to the last degree and some have several adjustments that must be handled. These features determine the type of set to be bought. Remembering that the purpose of the tuner is to differentiate between the signals from the various stations, how important it is to have a tuner that will really weed them out and

pick up the desired one—a feature known as "selectivity"! Selectivity is to be had in an easily managed form in so-called "regenerative" tuners of the coupled or "three-circuit" type, and we strongly urge the acquisition of this type of set. There are now on the market dozens of makes of "simplified" tuners, the operation of which is whittled down to a solitary knob or two, but in them the selectivity has been sacrificed either to save expense or in the mistaken belief that the public cannot learn to operate a modern tuner. Most of these single-circuit or simplified tuners are vicious things, and in truth a back-sliding to the early days of radio when we didn't know any better. Of course they bring in the signals good and loud, but they bring in an unwanted signal as well, and ships and commercial stations and perfectly law-abiding amateurs are heard in distressing fashion "all over the tuner".

The modern "three-circuit" tuner is capable of a high degree of selectivity so the above interference rarely occurs on it. Its alleged complication is gross exaggeration and anyone can master it in an hour and get not only good selectivity but actually louder signals over greater distances. From this it will be seen that the three-circuit tuner is emphatically recommended if the best results are wanted.

Some sets have the vacuum tube outfit built in their cabinet and some are separate. In either case one can get sets using one, two or three tubes. The first tube is necessary in every set. It takes the place of the crystal of simpler sets but does the job many times better. It is called a "detector" or "rectifier". This isn't a textbook so we'll let it go by saying that a detector is necessary, comes all hitched up for business, and generally works without trouble.

Now signals may be heard from long distances in the head-set with just the detector tube but it is often desirable to have louder signals, particularly to put out thru a loud-talking horn. This is accomplished by vacuum tube amplifiers but this time the tubes function to boost the strength of the signals passed thru the detector. Whether the amateur has one or two stages is almost standard now. It is not generally desirable to exceed two stages unless special precautions are taken to cut down stray noises.

Tube sets may be had for from \$10.00 to \$100.00. As in most things, the price one pays about determines the performance of the set, and it pays to get a well designed and well built one of reliable make.

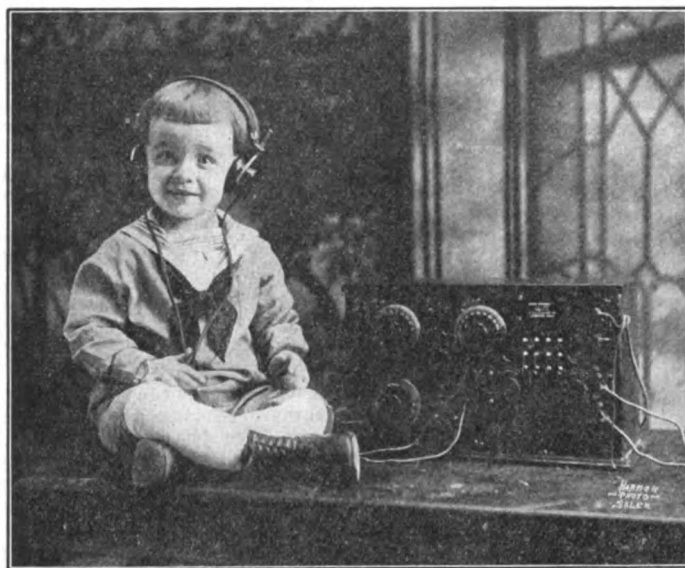
Two batteries are needed for the receiving set. One is to light the filaments of the tubes and is known in radio engineering as the "A" battery. Generally this is a lead plate storage battery of much the same type as used in automobiles. All vacuum tubes on the market in this country

are designed for use on a 6-volt battery. Such batteries are rated in "ampere-hours" capacity at one charging. The larger this rating the longer your set can be operated without recharging the battery tho the largest sizes are very heavy and bulky. An 80 A.H. battery is a good average. Dry cells are wholly unsuited to this work.

Then there is the "B" battery for the plate circuits of the tubes. These come in blocks of 22½ volts, made up of small flashlight cells sealed into units, and generally tapped for various voltages. They are a staple on the radio market. The voltage

having a horn attached to set a large volume of air in motion. Then there are countless devices consisting of a single telephone with a horn, or sometimes just a horn to which one or both of the regular telephones may be clamped. These make a simple and fairly satisfactory loud-speaker, generally enough for the average home. They have no amplifiers in themselves except the megaphone effect they use, and are to be used only when an amplifier is available—a detector alone in general will not give loud enough signals to actuate it.

A simple loud-speaker may be made at home by procuring a Baldwin telephone and an old phonograph horn, or by clamping the Baldwin receiver to the tone arm of a phonograph (horn or cabinet type) in place of the reproducer.



Why shouldn't he enjoy radio? It's in the family and both his Pa and Ma are old-time amateurs. This is Walter G. Estey, three-year-old son of Mr. and Mrs. F. Clifford Estey of Salem, Mass. Mr. Estey is sales manager of the Clapp-Eastham Co. and chairman of the Boston Executive Radio Council.

needed depends upon the set—generally between 18 and 22 volts on the detector and 45 or more on the amplifiers. The same "B" battery may be used for both—which means two blocks.

A good pair of telephone receivers of 2000 to 4000 ohms resistance completes the set. Several pairs can be used at the same time so that more than one can listen to faint signals. After all a head-set is the best way to get the most out of radio.

It is often very desirable, however, to put out the signals thru a loud-speaker so that they may be enjoyed by everyone in the room, much like a phonograph. There are several loud-speakers on the market, some embodying their own special tube amplifiers, which are well suited for this work. They connect in place of the head-set—in fact, they are merely an enlarged telephone

Thus outfitted the radio world awaits you. Broadcasts of entertainment, lectures and news can be heard in any part of the United States, and ships at sea and amateurs for hundreds of miles can be heard on their dot-and-dash telegraphy. Naturally it's not all roses—there's summer "static" that fries and crackles and almost drowns out signals, and sometimes leaky power lines and defective arc lights cause a terrible rumpus, but everybody has to put up with a little of this and there's still enough of sweetness to make it most fascinating.

There are amateurs in almost every town in the country—not newcomers in the game but "bugs" who have been at it for years, although more often than not they are just lads. They are the ones who know amateur radio and the novice can do no better than by making the acquaintance of a practical amateur. Amateurs are a splendid lot, willing and even anxious to help in the advancement of their chosen hobby. They'll help you put up that aerial, answer your questions, tell you how to hook up your gear, show you how bright to burn your bulbs and how to tune in signals. The quickest and surest way of finding out how many things that this article can't tell you is just this:—get in touch with a local amateur—he knows.

# Strays



It is rumored that the British Post Office Department is experiencing a change of heart and in change of its policy is going to allow every facility for the extension of wireless telephony in that country. England for some time has been watching the spread of popular interest in broadcasting in this country and does not intend to be outdone. An important announcement is expected in Parliament soon, according to press reports.

Probably government control of radio in England will turn out in the end to have been a very good thing as it will prevent the frenzied radio conditions that characterize our country at present. Britain has a more serious and sober way of going about things which will stand her in good stead in the expansion of popular home radio. Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Co., is quoted in the *New York Tribune* as saying "I don't want to see 'radio flu' here. In America the boom is rather premature. The equipment in use is rather primitive and not such as we should like to see employed here. I think that America is going ahead too fast in this direction, and I can foresee chaotic conditions if indiscriminate and vast use of wireless telephony comes."

We amateurs are having lots of new names applied to us these days. G. H. Dacy, in the "Scientific American", keeps up with the habit of the day by calling us "the American urchin".

Our guess is that there will be a whole lot of broadcasting stations closed up as soon as Secretary Hoover gets the authority needed to look after radio, as the Telephony Conference proposes he shall have. In other words, some broadcast stations exist today simply because an inadequate law gives no one the authority to prevent them from operating. It's a cinch there will be no more of this business of having every department store in a city trying to broadcast. The fellows with the poor modulation, the stations with the uninteresting programs, the unintelligent operators—out they'll go! Where there are a group of private broadcasting stations in the same community essentially duplicate each other's service, it probably will be considered that

they are unduly interfering and the Secretary of Commerce will exercise his power to revoke licenses.

Gee but it will be good to see some of the rottenest ones weeded out.

## QRA "6BO"?

In recent months some malefactor has been having great sport all by his lonesome in fooling various eastern stations into thinking they were hearing a "6". 6BO, he said he was, and he gave his name and town, and said he was using 500 watts of C.W., which of course might account for the very-QSA signals he made in the 8th and 3d districts. 8ZY, 3ALN, some nines, and many eights including 8BIL, 8AWP, 8AD, succeeded in connecting up with this "Californian".

The point is that it wasn't 6BO at all. Mr. Preston of that station suggests that the offender is around Pennsylvania some place, as most of the cards he has received are from that vicinity. Why not swing a loop on him and let us know your readings?

We would like to know who this bird is, and promise that upon receipt of sufficient information we shall do our level best to get the axe for him—for keeps.

"C.W. and the old A.R.R.L. Spirit did the job", says Keith Russell, 9AL, of Toronto, Canada, in explaining the newspaper publicity he got in placing his equipment and services at the disposal of the Power Company. Between 9AL and 8ANJ at Niagara Falls great assistance was given in relaying messages relating to repairs on the power cables. Canadian amateurs are on the job too.

We have received several dozen requests to print change of addresses and calls. If we start this hundreds more will undoubtedly come in, which it will be impossible to publish. We will, however, when specially requested, print the address at the head of each list of "Calls Heard" selected by us.

The Old Man says that C.W. sets ought to be called CQ sets.

We get mail addressed any old way but the prize one came in the other day addressed to the "Q Street Magazine". Hi!

"Your decrement must not exceed .Z"—  
*Radio Digest.*

We are sorry to state that many of the popular magazines predict increasing static this summer. We hoped with a million aeriels in the air that the distribution of static per aerial would decrease in proportion.

S. Kruse, who is engaged in experimental work for the John Hays Hammond laboratory, is at present one of a crew who are doing some experimenting between two radio-equipped ships in the Gulf of Mexico.

1GOF says that QST is improving every month judging from the pictures in the April issue.

Examinations will be given for the position of Junior Engineer for the Bureau of Standards on July 5th and August 23rd. Details may be obtained from the nearest Civil Service office.

It was evident to the Bureau of Standards from inquiries received from builders of the simple crystal receiver described in their Letter Circular 43 that there was need for description of a set possessing greater possibilities than the first one. A second publication is therefore being prepared—a 2-circuit receiving set with variable coupler. This set of course has greater selectivity than the single-circuit set and has the great advantage that most of the apparatus used in the first-mentioned outfit may likewise be employed in the new installation. This publication is Letter Circular LC-44, which will be issued as Bureau of Standards Circular No. 121 by the Superintendent of Documents for 5c a copy. The date of issue cannot yet be given.

Suggestion to American manufacturers contemplating the production of radio frequency transformers: mount them so as to go in a standard tube socket, whereby transformers may be easily changed for different wave length ranges.

We are informed that Mr. Linsey Winsor of Bakersfield, Cal., has received the call 6ZS "and will vibrate on 375 meters". Page Bee Palmer!

The unkindest cut of all is to have a newspaper call us the "American Radio Delay League". Maybe the Editor sent a msg by the A.R.R.L.

We note with interest that the "Radio Review" and the "Wireless World", both of London, have consolidated under the name of "Wireless World and Radio Review", which will be published weekly. The combination should result in a wonderful magazine to which we extend our most hearty wishes.

We have heard indirectly that the Vesta Battery has a range of 6,000 wave lengths. It must be highly damped, which eliminates the possibility of C.W. as an electrolyte.

KDKA has an acknowledgment card with a blank space for filling in the height of their aerial at the time they were reported. Maybe they get different wave lengths by hoisting or lowering the antenna.

According to 4BW California has nothing on Georgia. Grover Jones of Macon sells radio bugs at reduced rates a storage battery which when freed of its charge will be charged free once a month without charge.

In radio we are finding out that "all is not sweet that twitters".

Mr. H. H. Wish, who has been cartooning for QST lately, has been assigned the call 1PK although he is confined to his bed. He suggests that had it been 1QT (one quart) instead of 1PK (one peck) greater interest might have been aroused.

#### Changes at the QST Factory

Chas. A. Service, Jr., past vice-president of the A.R.R.L. terminated a pleasant connection with our headquarters office to become manager of the radio department of the Electric Supply & Equipment Co., with his office in Hartford. He was succeeded by Robert L. Northrop of Lynn, Mass., ex-1COA, who now enjoys the resounding title of office manager and executive assistant to the secretary. The lure of the commercial game was too strong for Bob Higgy of old 8IB, and he resigned his assistant editorship of QST to return to Columbus and embark in business on his own, being succeeded at our diggings by Boyd Phelps of 9ZT, Minneapolis. Phelps' acquisition by this office is our gain but the loss of the territory from whence he came, as in coming with us he has had to resign from the management of the Dakota Division and the temporary guidance of the Winnipeg Division, so ably led by him.

Phelps, poor unfortunate, came to us without a nickname of any sort. Accordingly one was manufactured for him by trying to pronounce his initials—"Beep". Beep is now the happy operator of station 1HX, Hartford, where he is proving to the world that his recent QST dope on "Radio below 200 meters" actually works by radiating good energy on waves as low as 70 meters—harmonics of course. Reliable communication is had with Boston on 130 meters. The boy's all right.

Thru an error in April QST the Thor-darson amplifying transformer was listed at \$4.00 whereas it should have been \$4.50.

## Read 'Em and Weep!

4CB of Morse, Sask., has worked many U.S. stations including 6AWT of Frisco, and has been heard in Hawaii on 15 watts. 6KA has been heard by 1BDI at Orono, Maine.

8ACF has been heard on detector only by several stations in Long Beach, Calif. He uses the same 10 watt set that got over to Scotland.

8HJ of Elmira, N.Y., has heard 6CU, 6KA and 6XAD on one tube and has been heard by 6XAD using 10 watts.

6ZF, 6ZG, 6ZI, 6ZS, 6ZZ, and 6XAD have all been heard at Oil City, Pa.

6ZZ, 6EH, 6WV, 6XAD, and 7AH have been heard at 1BDU, Winthrop, Mass.

6ZZ and 7MI were heard on one tube by 1CFJ at Portland, Maine.

8VY has been heard QSA or very QSA by 6XAD, 6ARF, 6AOW, 6ARE, 6RR, 6ZZ, 7LU, 7JS, 7TQ, 7ZS, (5:2A), and Can. 5CN on one 50 watt.

9APW worked 9BDF and 9AYS on a VT1. copied by 3JJ while working 9FZ on 5 watts; worked 8OZ, 8BDO and heard by 6XAD on 10 watts; added 5 more watts and worked 2FP, 8AWM, 8AIO and 8ADK.

6ZB, San Diego, Cal., on 20 watts was copied by Can. 3IL of Kingston, Ont.

8BRL works 5ZA, 6XAD, and 6BO(!).

6ZZ was copied thru heavy QRN at Can. 3DS, Kitchener, Ont.

8BDB has been reported QSA in Palo Alto, Calif. on 15 watts.

6AWP worked 9WU on 10 watts.

4EZ on one tube copied 6EN nearly an hour after the sun was up.

6AWP has been heard on 10 watts in Cleveland, Ohio, by 8AGZ; off Key West, Fla. on the S.S. McKelvey; at Yakutat, Alaska, on the S.S. Admiral Watson; and at Wailuku, Hawaii, by 6ZAC.

Soon we will reduce the above column by saying, "The following 6's have not yet been heard on the Atlantic Coast."

Wants no ur range? Call 3TS as fast as you can.

9AL in Chicago asks for relief. He is not transmitting but gets tons of cards reporting Canadian 9AL, Keith Russell, 11 Pinewood Ave., in Toronto, Can., on C.W.

What are your ideas on a good cover design for QST? We know many of you are close critics but we want some ideas now. We do not mean drawings, for we will tend to that, but ideas that will make good covers.

## OPERATING DEPARTMENT

(Concluded from page 50)

to work through the static, but no reports were received from the C.W. stations except that of 8BEX.

Southern Indiana shows a good total of messages, but the phone broadcasting sit-

uation is the cause of the drop in the number of messages handled in this territory. Everyone is supposed to stand by in southern Indiana for phone broadcasting until after 10 o'clock and a lot of the younger relayers turn in by that time.

The Committee of Radio Amateurs of Lafayette has adopted traffic regulations applying to every county, which provide:

6:00 A.M. to 5:30 P.M. Free Air.

5:30 P.M. to 6:30 P.M. Local Traffic.

6:30 P.M. to 9:05 P.M. Listening Period.

9:05 P.M. to 6:00 A.M. Long Distance Period.

This schedule has been faithfully followed and as a result the radio situation in and about Lafayette has improved greatly.

J. E. Hall, of Seymour, Ind., has been putting this city on the map. 9DYU, 9AMO and Mr. Hall's own stations, 9ASJ, have been handling about three hundred messages a month among them.

All routes in Northern Indiana are in working order and much traffic has been passed over them.

9DAX, 9PC, 9UC, 9ASB and 9BGF are now using fone and C.W. 9DAX is heard at 9HR at any time of day and will prove a reliable station.

## NEW ENGLAND DIVISION

P. F. Robinson, Mgr.

C.W. Messages: 1SD-105, 1ASF-89, 1PR-78, 1BDV-55, 1BRQ-32, 1FB-22, 1BKQ-54, 1PT-25, 1CMK-18, 1BYG-10. Total, 456.

Spark Messages: 1RX-275, 1CNI-240, 1SN-195, 1LZ-84, 1WQ-80, 1BYG-48, 1BJE-36, 1BRQ-36, 1AOK-33, 1DY-8, 1FB-8. Total, 1007.

In keeping with the reorganization of the Operating Department, the following have been appointed Assistant Division Managers in this division:

Maine: F. H. Pierce, 1BRQ; Connecticut: J. L. Reinartz, 1QP; Eastern Mass.: L. G. Cumming, 1FB; Western Mass.: A. S. McClean, 1JQ; New Hampshire: H. W. Bean, 1OE; Vermont: L. F. Packer, 1ARY; Rhode Island: J. F. Sullivan.

Further appointments covering the offices of District Superintendent will be announced as soon as these vacancies are filled by capable men.

Much of the joy in amateur radio in this division has been taken out by a great number of broadcasting stations, some of which "hog" the ether without regard to amateur affairs. It is not fair that the broadcast listener be given the entire evening and the amateur be crowded out until the wee small hours of the morning.

Daylight Sunday Tests have been arranged in order that a number of the stations operated by the younger fellows will have a chance to handle relay traffic without causing interference to the listening stations.



# Amateur Radio Stations



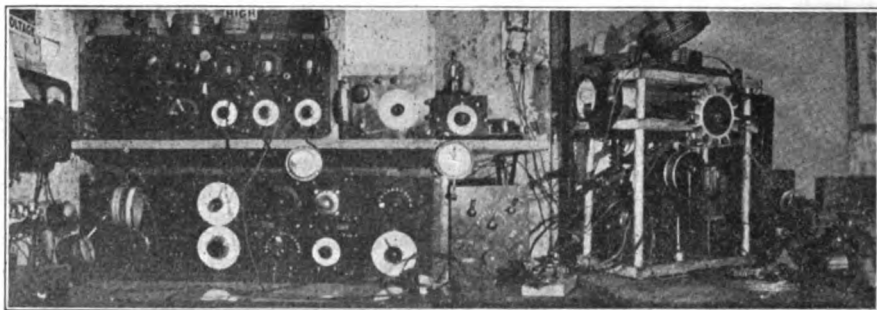
## 4EG, Woodruff, S. C.

The photo shows the station of W. C. Etheredge, A.R.R.L. District Superintendent of South Carolina. There are many novel features in design and arrangement worthy of note in this station. In building the set flexibility in wave range, unity in control, accessibility, and electrical efficiency were kept in mind.

The cabinet at the left contains four Formica panels 8 by 9 by  $\frac{1}{4}$  inches. Binding posts are provided on each panel so that by short strips the units are connected. Any of the panels may be removed without disturbing the others. Busbar wiring is used thruout. From left to right the panels

wound on a three inch tube and tapped every eight turns.

The upper cabinet contains three panels. The one to the left contains a Clapp-Eastham loose-coupler, tho not as much used as the three coil mounting below. The next is a spare detector with potentiometer control and the panel to the right is a two-step amplifier. Also setting on the shelf is a home-made wavemeter with a range of 150 to 3,000 meters, and an Amrad wave meter. The meters to the extreme left measure the voltage of the A and B batteries and a sensitive ammeter is in each filament circuit.



are as follows: coupling panel, wave control, detector, and plate circuit control. On the coupling panel is a three-coil mounting with a 43-plate variable condenser below, which is used across the tickler coil on long waves. The wave-control has a 43-plate variable condenser at the top connected in the antenna circuit and a Clapp-Eastham variometer at the bottom which is in the grid circuit for short waves. A variable condenser may be added across the secondary binding posts for long waves. The detector control uses a small variable grid condenser and an end-cell switch for the B battery. The plate control panel contains a variometer at the bottom and a plate loading coil at the top. The variometer has only twenty-four turns on the rotor and twenty-two on the stator which makes tuning easier. The short range of the variometer is made up by the plate loading coil of 88 turns of No. 28 wire

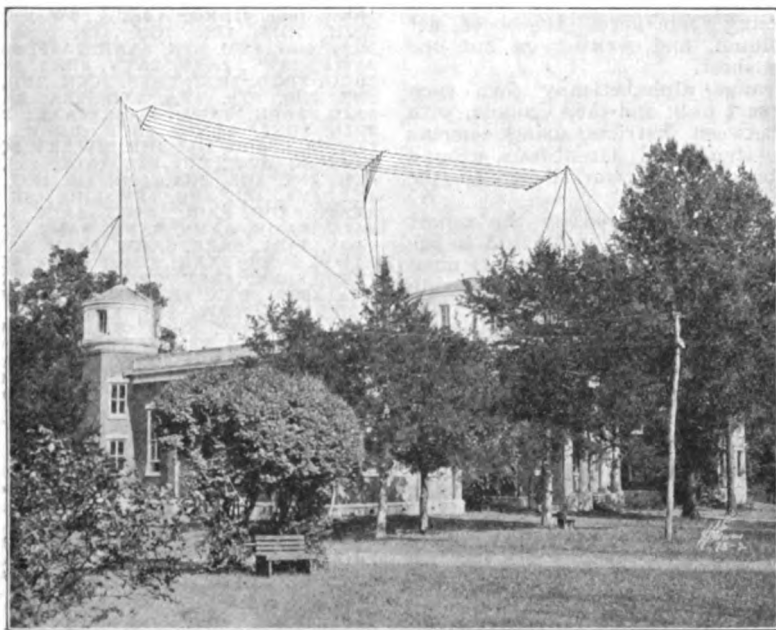
For 200 meter work a primary coil four inches in diameter with 8 turns of No. 22 wire is found best, used with a secondary of 28 turns of No. 28. For phone reception  $4\frac{1}{2}$  inch coils are used with 18 turns on the primary and 48 on the secondary. Honeycomb coils are used on the long waves but amateur radio is by far the most interesting.

The antenna is of five cables spaced  $2\frac{1}{2}$  ft. apart, 20 ft. long and 35 ft. high. Ground is obtained to water pipes and a counterpoise under the antenna.

The spark set shown to the right on the table in the frame consists of a  $\frac{1}{4}$  K.V.A. Thordarson transformer, Jewell thermocouple ammeter, Murdock antenna switch and O.T., Benwood disk on  $\frac{1}{4}$  horse motor, and an oil immersed condenser built in sections in storage battery jars. The glass plates are  $\frac{1}{4}$  inch thick and cut from broken pieces of windshield glass.

Since the photo was taken a CW and phone set has been added using short range but effective loop modulation with the "sure fire circuit." Filament voltage is obtained from a transformer whose core is made from an old 50 ampere watt-meter and now has a 440 turn primary winding of No. 28 enamel wire and a secondary of 32 turns of No. 18 tapped in the middle. The plate supply transformer is made on a core 6 by 7 inches outside and 1 1/4 inches thick. The primary has 330 turns of No. 18. The

secondary is wound on a fibre tube that slips over the other leg of the transformer and contains 1244 turns of No. 28 enameled wire with oiled paper between layers. Filter chokes are made of secondaries from an ignition coil on a 1 1/4 inch square closed iron core. The rectifier is made of 10 tumblers with 1/4 inch wide electrodes of aluminum and lead. Common cooking soda in distilled water is used, covering the plates a half inch. This makes the ideal inter-city set and shows what can be done in making most of it in the workshop.



## 5YE, University P. O., Miss.

5YE is the station of the University of Mississippi and has no doubt been heard by many of us.

The antenna is T type, six wires, 95 ft. long, spacing 38 inches, and well insulated. It is supported on two 55 ft. cypress poles on top of a building 45 ft. high. The flat metal roof directly below forms the ground and has about five thousand square feet soldered together and in addition is earthed in many places around the edge.

The transmitter is located in a special room directly below the center of capacity of the antenna. The transmitting set is mounted in a separate cabinet with glass doors. The aerial and ground leads are brought directly to the cabinet and the change-over switch is operated by distant control, making it unnecessary to bring the antenna circuit to the operating table. The transmitter is arranged for either synchron-

ous or non-sink operation with Acme or Thordarson transformers. The condenser is of 59 glass plates one-fourth inch thick, one foot square, and with heavy tinfoil circles eight inches in diameter. This follows closely Mr. Mathews article. "The Ideal Spark Transmitter", in April 1921 QST. The closed circuit is of three inch ribbon and heavy copper braid. The transformer is located in the compartment below with all care being taken in insulation and the prevention of induction in the power circuits. With eight inches of coupling the Jewell meter reads six amperes with exactly one k.w. input, power factor 85%.

The receiving equipment includes a Grebe CR-6 short wave regenerative set with two steps of audio frequency amplification, Baldwin and Brandes phones, etc. A DeForest fifteen panel set is used for long

(Concluded on page 66)

# Calls Heard



## HEARD DURING APRIL

### Unless Otherwise Specified

#### Instructions to reporters:

(1) Typewrite or neatly print the calls "double-spaced", on a separate sheet of paper, running them across the sheet, not down a column, and writing on but one side of the sheet.

(2) Arrange alphabetically thru each district, from 1 to 9, and then Canada, with no break between districts, using commas to separate items and parentheses around calls of stations also worked—as in the examples below.

(3) The period covered by the report shall be from the first of one month to the first of the following month. All lists must be received by us the 10th of the following month for publication in the next QST.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner and then make a second paragraph in identical form listing the C.W. stations. Commercial calls will not be published.

#### Pearl Harbor, T. H.

April 22-23rd: 6ZX 7:32 P.M., 6KY calling 6ZAC at 7:40, 6KI calling 6ZZ at 9:02, 6ZI from 9:57 to 10:30 telling 6ZAC QRL and again at 11:17 QSA; 6ZG calling 6ZAC at 10:20 and 10:28, 6ZAC QSA at all times, 6ASJ calling 6ASM at 12:26 and 1:22 several msgs copied from 6ZG, 6NY heard QRZ.

"Stations 6ZI and 6ZG are particularly to be complimented on their transmitters and workmanlike operating. Receiving was done with one detector tube and one step audio amplification. Will arrange schedules with any amateurs that wish to try their "transpacific" luck." Address Mr. A. L. Newton, Chief Radioman, U.S.N., U.S.S. Chicago, Flagship, Submarine Base, Pearl Harbor, T. H.

#### Ex-3AHA, Germany

Feb. 2 (2260 miles east of Cape Henry.) 7:05 7:23 A.M. G.M.T.: 2FP and 2BNZ on C.W., 2OM on spark. April 6th (In harbor, Kiel, Germany) 9 P.M.—"8 MT de 2LZ" (C.W.), 9:05—"2 OM de 2LZ", 9:22—"2 MZ de 2LZ tks om QRK QRN what wave does 8MT work on? K" All of above heard with Paragon circuit and only one tube.

#### Canadian 3BP, Newmarket, Ont.

Spark: 1AMQ, 1ARY, 1AW, 1AZK, 1AZW, 1BEP, 1BKQ, 1BOQ, 1BRQ, 1CNI, 1COK, 1CZ, 1GM, 1HO, 1LZ, 1RV, 1SN, 1XZ, 1YB, 2AER, 2AHJ, 2AJE, 2ARB, 2ARY, 2AXK, 2BEM, 2BEO, 2BLP, 2CCX, 2DK, 2DN, 2DX, 2EL, 2FF, 2JZ, 2PV, 2SZ, 2TJ, 2WB, 2WT, 2XQ, 3AAG, 3ABB, 3AJD, 3AQR, 3ASO, 3AUW, 3HX, 3FB, 3FP, 3GX, 3HJ, 3IL, 3LR, 3PU, 3TJ, 4BF, 4BI, 4FD, 4GU, 4FJ, 5HK, 5JB, 5RZ, 5SM, 5ZU, 5AFB, 5AFG, 5AHQ, 5AMB, 5AMZ, 5ARD, 5ARS, 5AUV, 5AXN, 5AXY, 5AYC, 5AZF, 5BAZ, 5BBI, 5BBK, 5BCO, 5BFX, 5BFY, 5BJT, 5BNY, 5BRL, 5CR, 5CS, 5EW, 5KY, 5LO, 5OI, 5OS, 5PT, 5QY, 5TB, 5TT, 5UC 8WD, 5XE, 5XAE, 5YAE, 5YN, 5YU, 5YV, 5ZA, 5ZAE, 5AAW, 5ACB, 5AEQ, 5AGR, 5AHX, 5AIU, 5AIV, 5AJH, 5AKM, 5ALM, 5AOU, 5APE, 5AQZ, 5ASK, 5AUA,

5AUL, 5AVP, 5AWZ, 5AXU, 5AZA, 5AZF, 5BAK, 5BED, 5BFG, 5CA, 5CBA, 5CS, 5DHZ, 5DMJ, 5DMP, 5DOI, 5DPB, 5DQM, 5DSO, 5DWP, 5DZY, 5GC, 5KD, 5KI, 5LF, 5MC, 5OF, 5OX, 5PS, 5RC, 5SL, 5SN, 5TV, 5UG, 5VL, 5WC, 5WO, 5WX, 5XT, 5YAC, 5YAK, 5YAJ, 5YB, 5YQ, 5ZH, 5ZJ.

C.W.: 1ADL, 1AJP, 1AMQ, 1ARY, 1ASF, 1BDI, 1BKA fone, 1BKQ, 1BSD, 1BWJ, 1CIK, 1CIV, 1CJH, 1CJZ, 1EE, 1ON, 1PR fone, 1PT, 1UJ, 1XAD fone, 1XM, 1YK, 2AAB, 2AJF, 2AME, 2ANZ, 2AWF, 2AXK, 2AXV, 2AYV, 2BEA, 2BEH, 2BNZ, 2BQU, 2BQD, 2BTJ, 2BYS, 2CCK, 2EH, 2FP, 2KP, 2NZ, 2SQ, 2TP, 2VA, 2XQ, 2ZK, 3AAG, 3AAY, 3AJD, 3ALN, 3ANJ, 3AQR, 3AXK, 3BA, 3BHL, 3BIJ, 3BNI, 3BNU, 3BOF, 3BUR, 3BZ, 3CM, 3FM, 3FR, 3GH, 3HJ, 3HR, 3IW, 3KM, 3OF, 3QZ, 3RF, 3SM, 3SQ, 3VW, 3ZO, 3ZZ, 4AD, 4AS, 4BF, 4BY, 4EH, 4FT, 4GL, 4GX, 4OO, 4IL, 4KC, 4LP, 4ME, 4XA, 4YA, 4ZC, 5DO, 5FV, 5HO, 5JB, 5XA, 6BO, 6XAD, 6ADG, 6AGO, 6AGZ, 6AIM, 6AJO, 6AJX, 6ALT, 6AMK, 6AMS, 6ANB, 6ANC, 6AOB, 6AQO, 6AQF, 6AQZ, 6ARK, 6ARW, 6ASM, 6AVL, 6AWM, 6AWP, 6AXB, 6AXK, 6BAJ, 6BBD, 6BDU, 6BEF, 6BEO, 6BEX, 6BFX, 6BFY, 6BNI, 6BOX, 6BQL fone, 6BSB, 6BXA, 6BZH, 6CAZ fone, 6CBJ, 6CFS, 6CKO, 6DV, 6DW, 6JS, 6LB, 6LW, 6NJ, 6OM, 6OW, 6QZ, 6SP, 6UC, 6UK, 6US, 6WY, 6XAK, 6XV, 6ZY, 6ZM, 6ZZ, 9AAP, 9AAS, 9AAV, 9AAY, 9AEQ, 9AFO, 9AJA, 9ANE, 9AOR, 9ARK, 9AVA, 9AWM, 9AXF, 9AZE, 9AZH, 9BFO fone, 9BJB, 9BJN, 9BLO, 9BRL, 9BSG, 9CT, 9DAX, 9DOF, 9DOS, 9DZQ, 9EI, 9GC, 9GL, 9IL, 9IO, 9KP, 9PS, 9QE, 9UC, 9WA, 9WI, 9WQ, 9WU, 9ZAF, 9ZG 9ZL, AN-5.

#### Canadian 3EY, Toronto, Ont.—One tube

Spark: 2DM, 2FP, 2SZ, 2AJE, 3HJ, 4CX, 8AFB, 8AHQ, 8AJW, 8AMQ, 8BRL, 8XE.

C.W.: 1PR, 1PT, 1RD, 1YK, 1AJF, 1AMQ, 1ARY, 1BGF, 1BKQ, 1BWJ, 1XM, 2NZ, 2AAB, 2BEA, 2BTJ, 2ZK, 3BA, 3HG, 3VW, 3ALN, 3ANY, 3BEC, 3BHL, 3BUV, 3ZO, 4IV, 5FV, 5BO, 5BV, 5OZ, 5PT, 5QB, 5SP, 5ACF, 5ADG, 5AGO, 5AJO, 5ANJ, 5AOC, 5ARK, 5BCL, 5BDE, 5BDU, 5BLZ, 5BPI, 5BQU, 5UK, 5VY, 5XB, 5XE, Can. 3BP.

#### Canadian 3JI, Toronto, Ont.

C.W.: 1II, 1ON, 1PR, 1QP, 1TS, 1VQ, 1XA, 1XZ, 1YB, 1ADL, 1AJP, 1AMQ, 1ARY, 1AVR, 1AZW, 1BAS, 1BDC fone, 1BDI, 1BEP, 1BGF, 1BKA fone, 1BKQ, 1BLE, 1CAH, 1CGS, 1CHJ, 1CMK, 1CNF, 1CNR, 1CVJ, 2DN, 2FP, 2HI, 2KP, 2OF, 2SQ, 2WI, 2WT, 2XB fone, 2XJ fone, 2ZK, 2AJA, 2AJW, 2APA, 2ATS, 2AWF, 2AWS, 2AYV, 2BEB, 2BEJ, 2BEM, 2BFT, 2BFX, 2BGI, 2BJL, 2BLP, 2BNQ, 2BNZ, 2BQA fone, 2BQU, 2BQV, 2BTW, 2BXP, 2BYS, 2BVZ, 2CBW, 2CCD, 2CFT, 2CGQ, 2CJV, 2DTU, 3BA, 3BG, 3BZ, 3CA, 3CC, 3FP, 3GP, 3IL, 3IW, 3NH, 3NO, 3PB, 3QV, 3QZ, 3VS, 3WF, 3ZN, 3ZO, 3ZC, 3AAY, 3ADX, 3AJD, 3ALU, 3ANJ, 3ANY, 3APQ, 3BEC, 3BFS, 3BHL, 3BIJ, 3BNU, 3BOF, 3BUV, 3BRW, 4AS, 4BQ, 4BY, 4CO, 4DE, 4DS, 4EB, 4EH, 4EL, 4EN, 4EU, 4GL, 4GX, 4ID, 4IL, 4IV, 4KC, 4LP, 4XA, 4XD, 5BF, 5DA, 5FV, 5HO, 5IF, 5KA, 5BES, 5EN, 6XAD, 6AM, 6BO, 6CG fone, 6DV, 6EA, (6HJ) 8HM, 8HT, 8KH, 8KI, 8LB fone, 8LT, (8NB), (8ND), 8OS, 8PN, 8PT, (8QB), 8QZ, 8RQ, 8SE, 8SP, 8TB, 8UC, (8UE), 8VV, 8WR, 8XE, 8ACF, 8ADG, 8AFL, 8AGG, 8AGK, 8AHK, 8AHL, 8AHR, 8AIG, (8AII), 8AIO, 8AJT, 8ALB, 8AMB, (8AMK), 8ANB, 8ANJ, 8ANE, 8AOA, 8AOC, 8AQF, (8AQZ), 8ARK, 8ASK, 8AUE, 8AUY, 8AVK, 8AVL, 8AVW, 8AWM, 8AWP, (8AWW), 8AWX, 8AWY, 8AXB, 8AXC, 8BAE, 8BAJ, 8BBD, 8BCQ, 8BDB, 8BDI, 8BDU, 8BEF, 8BEO, 8BEX, 8BFX, 8BGF, 8BIL, 8BJO, 8BJR.



80FC, 8CJX, 8CKM, 8CKO, 8CLW, 8CMM, 8CMX, 8BJS, 8BJV, 8BKE, 8BLW, (8BLZ), 8BNJ, 8BNU, 8BQL, 8BRL, 8BSF, 8BUQ, 8BUX, (8CBJ), 8CCX, 8CNG, 8COL, (8COO), 8CQH, 8CQL, 8XAD fone, 8YAA, 8ZAF, 8BP, 9EL, 9GL, 9IL, 9IO, 9KM, 9KP, 9QE, 9SO, 9VK, 9WC, 9WQ, 9XI, 9AAY, 9AIY, 9AJH, 9AJM, 9AKD, 9AMO, 9ANE, 9AOG, 9AOU, 9ARK, 9BAA, 9BAF, 9BGH, 9BHE, 9BHQ, 9BLB, (9BLC), 9BLK, 9BRL, (9BTA), 9CBA, 9DAX, 9DKY, 9DTA, 9DZQ, 9YAE.

Spark: (8AHQ), (8ASL), (8AXN), (8CBJ).  
Canadian C.W.: 2BG, 3DS, (3FK) fone, (3KP) fone, (8SJ) fone, (31N) fone.

### 1BRQ, Lewiston, Maine

Spark: 1AA, 1CC, (1FM), 1GM, 1HO, 1JT, (1LZ), 1MA, (1QO), (1RV), 1SN, 1SZ, 1WG, 1YB, 1YD, (1ACO), 1AJE, (1AKG), 1AKQ, 1ANZ, 1AOK, 1APO, (1ARY), (1AUV), 1AWB, 1BCF, 1BFU, (1BHG), (1BHE), (1BJS), 1BOE, (1BQL), 1BSD, (1BVH), (1CCH), 1CGI, (1CGU), (1CIB), 1CJA, 1CNI, 1COK, 2AAF, 2AD, 2AER, 2AFD, 2AHU, 2AJD, 2AJE, 2APB, 2AQI, (2ARF), 2ARY, 2AWF, 2AXK, 2AY, (2BCC), 2BFU, (2BML), 2BQ, (2BQU), (2BSC), (2BY), 2CT, (2DN), 2EH, 2EL, (2FP), 2JS, 2JZ, (2MN), (2OX), 2PF, (2PV), 2RM, 2SP, 2TS, 2ABB, 2ABF, 2AC, 2AGT, 2AJD, 2AJP, 2APB, 2APD, 2ARD, 2ARN, 2AWE, 2AY, 2BFM, 2DN, 2FP, (2QN), 2RW, 2WB, 2EA, 2ADE, (2ADQ), 2AFA, 2AFB, 2AFO, 2AHE, 2ALO, 2APS, 2AQO, 2ARD, 2AW, 2BAZ, 2BDE, 2BKN, 2BRL, 2BSY, 2BXY, 2CHV, 2DY, 2EW, 2JJ, 2LB, (2MZ), 2RQ, 2VQ, (2WE), 2UY, 2DSO, 2VL.

C.W.: 1AGI, 1AJP, 1AKA, 1AKG, 1AMQ, 1ANQ, (1ARY), 1AVR, 1AZI, 1AZW, (1BAS), 1BBM, 1BCF, 1BDC, (1BDI), 1BEJ, 1BEP, 1BGF, 1BIE, (1BKK), 1BKQ, 1BLE, 1BLT, 1BQA, (1BQE), 1BQJ, 1BSD, (1BUA), 1BWJ, 1BW, 1CAK, 1CAY, 1CGL, 1CGS, 1CIK, 1CJH, 1CMK, (1CNR), 1CQS (1II), 1JZ, 1ON, (1PR), 1QP, 1RD, 1RH, 1UJ, 1VT, 1XB, 1XM, (1YK), 2AAB, 2ACQ, 2AEH, 2AFP, 2AGB, 2AJA, 2AJR, 2AK, 2AVU, 2AWF, 2AWL, 2AYV, 2BAG, 2BCL, 2BEA, 2BEH, 2BII, 2BLP, 2BML, 2BNZ, 2BP, (2BQU), 2BQT, 2BQU, 2BQY, 2BTJ, 2BTW, 2BTZ, 2BXP, 2CBT, 2CC, 2CCD, 2CEN, 2CFT, 2CFT, 2CGQ, 2CJN, 2CT, 2DX, 2EV, 2FP, 2GU, 2JW, 2KV, 2LO, 2OF, 2OX, 2QZ, 2RF, (2RY), 2TS, 2UD, 2VW, 2AAO, 2AAY, 2ABB, 2ACZ, 2AIN, 2APQ, 2BIJ, 2BKO, (2BNU), 2BOF, 2BTI, 2BUV, 2BZ, 2CA, 2CC, 2FR, 2HG, 2IL, 2IW, 2NH, 2NO, 2QZ, 2RS, 2VW, 2ZO, 2BF, 2BY, 2DC, 2DS, 2GL, 2GX, 2VDS, (2AGO), 2AHK, 2AIO, 2AKQ, 2ALT, 2AMN, 2AQF, 2AQO, 2AUH, 2AVL, 2AVO, 2AVW, 2AWM, 2AWP, 2BBD, (2BDU), 2BEO, 2BLX, 2BSS, 2BUQ, 2BX, 2BY, 2CFP, 2CLW, 2DV, 2LB, 2LS, (2NB), 2NX, 2OZ, 2PR, 2QB, 2RK, 2SC, 2SE, 2SP, (2VD), 2VY, 2XE, 2ZK, 2ARK, 2BP, 2EI, 2FM, 2WQ.

### 1XZ, Worcester, Mass.—All C. W.

1BV, 1EE, 1GP, 1HX, 1IX, 1JT, 1IW, 1PT, (1QP), 1RR, 1TS, (1UJ), 1XE, 1XM, (1XX), (1YB), 1YD, (1YK), 1ZE, 1ADL, 1AIR, 1ALS, 1ARY, 1ASF, 1AWB, 1AWH, 1AZJ, 1BBC, 1BBW, 1BES, (1BET), 1BKA, (1BKE), (1BKQ), 1BLN, (1BRG), 1BRQ, 1BYG, (1BYK), 1CAC, 1CEB, 1CIK, (1CNE), 1CNF, (1CNR), (1CPN), 1CQW, 1XAD, 2CK, 2DN, (2EH), 2FC, 2OE, 2RU, 2SQ, 2VH, 2WB, 2WR, 2WT, 2WX, 2XA, 2XJ, 2AAB, (2AFP), 2AJD, 2AJE, 2AJR, 2ANJ, 2AVR, 2AXK, 2BCF, 2BDQ, 2BEB, 2BEM, (2BFX), 2BIJ, 2BNC, 2BNZ, 2BQU, 2BUM, 2BZV, (2CAF), 2CCD, (2CHG), 2CIZ, 2BA, (2BG), 2CZ, 2FM, 2FP, (2FS), 2IW, 2JZ, 2JH, 2OF, 2QV, 2SH, 2VW, 2WF, 2XW fone, 2ZO, 2ZY, 2ZZ, 2ADT, 2ADK, 2AJD, (2ALU), 2ANJ, 2ANY, 2APT, 2ARR, 2ARY, 2ARU, 2ATJ, 2AVS, 2AWH, 2BAL, 2BHL, 2BIJ, 2BJY, 2BNU, 2BTK, (2BUV), 2BVF, 2AX, 2BY, 2EH, 2GL, 2IL, 2IV, 2AA, 2JB, 2CG, (2BO), 2CK, 2CN, 2DV, 2EV, 2LB, 2LQ, 2PN, 2PT, (2QZ), 2RV, 2VY, 2WY, (2XE), 2YD, (2YU), (2ZZ), 2ABM, 2AGO, (2AHK), 2AJX, 2AJV, 2ALB, 2ANB, 2ANR, 2APD, 2APR, 2APT, 2AQO, 2ARD, 2ARK, 2ARW, 2ASM, 2AVD, 2AVL, 2AWH, (2AWM), 2AWY, 2AXC, 2BCL, 2BDH, 2BEF, (2BKE), 2BLX, 2BQU, 2BQV, 2BSY, 2BTO, 2CCD, 2CCM, 2CGB, 8CJX, 8CNG, 8COO, 8COW, 8XAK, 8ZAE, 9BP, 9BS, 9CT, 9EI, 9KM, 9KP, 9PS, 9PT, 9WQ, (9AAP), 9AFN, (9AIY), 9AJA, 9AOG, 9ARG, 9AWO, 9BED, 9BPC,

9BSG, 9CAE, 9CBA, 9CBR, 9DAX, 9DEA, (9DQG), 9DOH, Can. 8CZ.

### 1PR, Newton, Mass.

C.W.: 1ACO, (1ADL), 1AGI, 1AIP, 1AJP, (1ARY), (1AWO), 1AZW, (1AZX), 1BDC, 1BDI, (1BET), (1BKQ), 1BPZ, 1BQE, 1BQL, (1BRQ), 1BSD, 1BYM, 1CAK, 1GCT, 1CIK, (1CFN), 1CSS, (1EE), 1IL, (1LZ), 1ON, 1PB, (1QP), (1UJ), (1VT), 1XZ, (1YB), 1ZE, (2AAB), 2AIF, 2AJA, 2AWL, 2AQH, 2AQI, 2AWF, 2AWL, (2XK), (2AYV), 2AZZ, 2BCF, 2BEA, 2BEB, (2BEH), 2BGI, 2BGF, 2BJQ, (2BLP), (2BNZ), 2BQD, 2BQU, 2BRE, 2BTJ, 2CBW, 2CFL, 2CIZ, 2DK, (2DX), (2FC), 2FP, 2KP, 2LQ, 2LH, 2NZ, 2RY, 2SQ, (2WB), 2WXM, (2ZK), 2ZK ph, 3AJD, (3ALL), (3ALN), (3ALU), (3ANY), 3AQH, 3ATG, (3BEC), (3BIJ), (3BNU), (3BTK), 3BUV, (3BZ), 3CC, 3EM, (3FM), 3GH, 3IL, 3IR, (3IW), 3NH, 3QZ, (3VW), 4BY, 4GL, 4II, NX4, 4ZA, 4ZE, 5DA, 5FV, 5LA, 5NZ, 5AFJ, 5AGK, 5AGO, 5AHQ, 5AHK, 5ALT, (5AMK), 5ANB, 5AQF, 5AQZ, (5ARK), (5ASV), 5AUH, (5AVL), (5AWM), 5AWX, 5AXB, 5AXC, 5AXY, 5BCL, 5BDU, (5BEO), 5BEF, 5BGD, (5BIL), 5BJS, 5BOO, 5BKE, (5BLX), 5BLT, 5BNU, 5BQV, 5BSY, 5BSO, 5BU, 5BUQ, 5BUX, 5CJH, 5CFP, 5CHX, (5CMM), 5CNN, 5CQL, (5COO), 5CPC, 5CPG, 5CTZ, 5DV, 5EV, (5HJ), 5JJ, 5KS, 5NB, 5OZ, 5PN, 5PT, 5UC, 5UK, 5VJ, (5VV), 5XE, 5AAP, 5ADK, 5AIY, 5AJA, 5AJH, 5ARK, 5AVG, 5AYH, (5AXF), (5BLC), 9CT, 9DAX, 9DKY, 9DRQ, 9DZQ, 9FZ, 9KM, 9KP, 9PF, 9WU, (9UH), 9ZL, Can. 2BG, 3BP, 3IZ, 9AL, 9AW.

Spark: 1ADC, (1ARY), 1AZK, 1BHR, 1BOP, 1BOQ, 1BPZ, (1BRQ), 1FM, (1YB), (1YD), 2AJE, 2AQI, 2AWF, 2CT, 2DN, 2FP, 2JZ, (2PV), (2SZ), 2TS, 2WB, 2ZO, 2HJ, 2BA, 2WT, 2FD, 2ACF, 2AHQ, 2AXO, 2AXY, 2BSY, 2MZ, 2UQ, 2XE, 2AAW, 2ARG, (2AXF), 2AZA, 2DZI, 2DXM, Can. (2BP), 3GI, 3FO.

### 1BGF, Hartford, Conn.

Spark: (1AW), 1GM, (1QO), 1RX, 1YB, 1ADL, 1AGI, 1AKG, (1BEF), 1BFI, (1BHW), (1BYI), 1BJR, 1BOP, (1BOQ), 1BRL, 1BRQ, 1BTP, (1BUC), 1CQS, 2DN, 2NZ, 2TF, 2AJE, 2BZ, 3FP, 3GX, 3PU, 3XW, 3YP, 3ABB, 3ARN, 3BHL, 4CX, 4DL, 4GX, 5DA, 5XA, 9KP, 9OX, 9UU, 9UG, 9AAW, 9AWZ, 9AZA.

C.W.: 1AL, 1DR, 1HX, (1II), 1QP, (1TS), 1UJ, 1VQ, 1VT, (1XM), 1XZ, 1ZE, (1AJP), (1ALY), 1AMQ, (1ARY), 1ATQ, 1AUN, 1AWB, (1AYL), 1AYZ, 1BBW, 1BCB, (1BDC), 1BES, 1BGC, 1BIK, 1BKA, 1BKQ, 1BNE, (1BNT), 1BOI, 1BQE, 1BQK, 1BSD, 1BWJ, 1CAK, 1CBJ, 1CGS, 1CJH, 1CJZ, 1CMK, 1CNE, 1CNR, 1CNI, 1CWR, 2BZ, 2CT, 2DK, 2DZ, 2FP, 2FZ, 2OE, 2SQ, 2TF, 2ZK, 2AEH, 2AIF, 2AJO, (2AWF), 2AYU, 2AYV, 2BEA, 2BEH, 2BEM, (2BFZ), 2BNZ, 2BRC, 2BTJ, (2BZV), (2CBW), 2CCD, 2GCK, 2CHG, 3BG, 3BU, 3FR, 3IW, 3KM, 3OM, (3QV), 3QZ, (3RF), 3VS, 3XL, (3ZO), 3ADK, 3AJO, 3ALL, 3ALN, 3ALU, 3ANY, 3BIJ, 3BNU, 3BTK, 3BUV, 3XAA, 4BU, (4GL), 4LP, (4ZC), 5FV, 5XU, (6ZZ), 8AW, 8BO, 8DY, 8IX, 8NM, 8NO, 8OU, 8OW, 8PT, 8SE, 8XE, 8ZE, 8ABV, 8ADG, 8AGO, 8AIO, 8AQF, (8AQO), 8ARK, 8ASM, 8AUX, 8AVD, 8AVL, 8AUK, 8AWM, 8AWP, 8AXC, 8BCC, 8BDB, 8BDH, 8BDU, 8BEF, 8BFX, 8BGV, 8BKE, 8BLX, 8BSY, 8BWK, 8CAY, (8CBJ), 8COO, 8CQL, 8ZAE, 9BF, 9EI, 9FZ, 9II, 9IL, (9IO), 9KM, 9UC, 9WA, 9WQ, 9WU, 9AAW, 9AAY, (9AJA), 9AJH, 9ARK, 9AWZ, 9BED, 9BLC, (9CBA), 9DGD, 9DQG, 9DSO, 9ZAF, C3BP, C3CZ, C3EI.

### 1ASF, Medford, Mass.

Spark: 1ADL, 1AZK, 1BOQ, 1BRQ, 1BYB, 1CM, 1COK, 1HO, 1YB, 2AAF, (2AHU), 2AJE, 2ARY, 2AWF, 2CT, 2DN, 2EL, 2FP, 2JZ, 2RM, 2ZN, 2AJD, 2ARF, 2FP, 2HJ, (2TA), 2WU, 4BI, 2AHQ, 2AQO, 2EV, (2ZO), 2TU.

C.W.: 1ADL, 1AGI, 1AIP, (1AMQ), 1AMS, (1ARY), (1AZW, ditte), (1AZX), (1BAS), 1BBW, 1BDI, (1BES), 1BGF, (1BKQ), 1BSZ, 1BW, (1BYN), 1CAK, (1CGS), (1CHJ), 1CIH, 1CJA, (1CMK), 1CNE, 1CNF, 1CNR, 1EE, 1HX, 1II, 1JT, (1PT), 1UF, (1VT), 1XAD, (1YK), 1ZE, (2AAB), 2BS, (2ACT), 2AEH, 2AF, 2AID, 2AIF, 2AJA, 2ALP, 2AME, (2AQU), 2AWL, (2AYV), 2BBN, 2BCF, 2BCW, 2BDG, 2BEA, 2BEB, (2BEH), 2BER, 2BFX, 2BG ditte, 2BGI, 2BJH, 2BLP, (2BNZ),

2BQH, 2BQE, (2BTJ), (2BTW), (2BWV), 2BXP, 2BYS, (2BZV), 2CAH, 2CBG, 2CBQ, (2CBW), 2CCD, 2CCE, 2CCL, (2CCU), 2CEC, 2CFI, 2CFT, 2CIM, 2CIZ, 2CQG, 2DTU, 2DX, (2EH), 2FC, 2FG, 2FP, 2FZ, 2GF, 2IZ, 2KV, (2KP), 2NZ, 2OF, 2PB, (2RM), 2RU, (2RY), 2VC, 2WR, (2ZK), (3ADX), 3AII, 3AJD, (3ALN), 3ALU, 3ANQ, (3AQF), 3ASO, 3ATZ, (3AVY), 3BDM, 3BG, 3BHL, 3BIJ, (3BJY), 3BLF, (3BNU), 3BRC, (3BTK), 3BWV, 3CC, (3FB), (3FM), (3FP), 3FR, (3GH), 3GZ, 3HG, 3IW, (3QZ), (3QV), 3RF, (3VS), 3VW, 3WF, 4BY, 4CK, 4CO, 4GL, 4GX, 4XB, 4YA, 5FV, 5UL, (8AGO), 8AIO, 8ALT, (8AMK), 8AMM, 8ANR 8APH, (8AQO), 8AQR, 8ARK, 8ARU, 8AVD, 8AVL, 8AWM, 8AWP, (8BDB), (8BDO), 8BDU, (8BEF), 8BIS, 8BJO, 8BJS, 8BK, 8BKE, 8BSO, 8BU, (8BUX), 8BXH, 8CBJ, 8CMM, (8COO), (8DV), 8DR, (8HJ), (8HM), 8NV, 8OZ, 8PT, (8QB), 8QZ, 8SE, (8UK), 8XE, 8XI, 8Z, 8ZAE, 9AAV, 9AIY, 9BDB, 9BLC, 9DZQ, 9FZ, 9IL, 9IO, 9KP, 9QE, 9XI, Can. 3BP, (3CZ), 9AL.

### 2AWF, Albany, N. Y.

Spark: 1AA, 1ACO, 1AW, 1BOP, (1BOQ), (1BRQ), 1CNI, 1GM, 1HO, 1RV, 1RX, 1YD, 2AAF, 2ABM, 2AJE, 2AQI, 2AR, 2CGJ, 2CT, 2DN, 2EL, 2RM, 2TS, 2WB, 3ABB, 3AGT, 3AOV, 3AQZ, 3EH, 3FB, 3FP, 3GX, 3HJ, 3IL, 3NB, 3PU, 3QN, 3RW, (4CX), 8ACF, 8AFB, 8AHH, (8AHQ), 8AHZ, 8AIC, 8AIJ, 8ARD, 8AUY, 8BEP, 8BSS, 8BSY, 8CDI, 8CH, 8CHV, 8CQL, 8EB, 8FT, (8JJ), 8KY, 8LB, 8RQ, 8TT, 8VQ, 8WO, 8WZ, 8ZO, 9AAW, 9AGR, 9AWP, 9DCX, 9DHZ, 9DSO, 9KI, 9MC, 9OX, 9UH, 9YB, Can. 3BP, 3FQ.

C.W.: 1AYZ, 1AZW, (1BRQ), 1BWQ, 1CAC, (1CNC), 1CNR, 1JT, (1QP), 1UJ, 1XZ, 2AJR, 2AYV, 2AZZ, 2BCE, 2BEA, 2BEB, 2BEM, 2BFZ, 2BND, (2BRC), 2CCD, 2CFT, 2DX, 2FP, 2FZ, 2KP, 2NZ, 2OF, 2VH, 2WI, 2ZL, 3AAD, 3ADT, 3ALU, (3ANJ), 3ANY, 3AQH, (3AWH), 3BA, 3BG, (3BHL), 3BIJ, 3BJY, 3CC, 3FS, 3FV, 3HG, 3IW, 3KM, 3QV, 3SH, 3VW, 3XL, 3XZ, 3ZO, 3ZY, 4BQ, 4BY, 4EB, 4EH, 4GH, 4GL, 4IV, 4KC, 4LP, 5DO, 5FV, 5RL, 5WO, 8AGO, (8AJA), 8ANE, (8ANJ), 8AQO, 8AQZ, 8ARK, 8ARW, 8ASM, 8AU, 8AVD, 8AWM, 8AWY, 8AXC, 8BKE, 8BLX, 8BO, 8BPU, 8COO, 8CZD, 8DV, 8FT, 8HM, 8LB, 8LX, (8PN), 8QZ, 8TB, 8UK, 8VY, 8XAK, 8XE, 8XV, 8XWA, 8YM, 8ZAE, 8ZZ, 9AAP, 9AJH, 9AOU, 9ARG, 9BP, 9DEA, 9DQG, 9DZZ, 9EI, 9FZ, (9IL), 9KP, 9SO, 9XI, 9ZL.

### 2BNZ, 10 Hawthorne Pl., E. Orange, N. J.

C.W.: 1ADO, 1AW, 1CR, (1ES), 1HK, 1HX, 1II, (1PR), 1PT, 1QP, 1SN, 1UJ, (1KD), 1XE, 1XM, 1XZ, 1ZE, 1ADL, 1AIP, (1AJP), 1AKG, 1AKL, 1ALE, 1ALW, 1AMQ, 1AQJ, (1ARY), (1ASF), 1AVR, 1AWB, (1AXD), (1AXW), (1AZW), 1BDC, 1BDI, (1BEA), (1BES), 1BJH, 1BKO, (1BKQ), 1BLE, 1BNT, 1BOQ, 1BQE, (1BSD), (1BWJ), 1CES, 1CGS, 1CIK, (1CMK), 1CNR, 2FC, 2HI, (3BA), 3BH, (3CA), (3CC), 3CF, 3CZ, 3EM, 3FP, (3FS), 3GH, 3HG, (3HJ), (3IL), (3IW), (3JL), 3LC, 3QV, 3QZ, (3TJ), 3TT, (3UC), (3UQ), 3VQ, (3VW), (3ZO), 3XW, 3YB, 3YD, 3YF, 3YH, 3YK, 3YV, 3YX, 3YZ, 3ZB, 3ZC, 3ZD, 3ZE, 3ZF, 3ZG, 3ZH, 3ZI, 3ZJ, 3ZK, 3ZL, 3ZM, 3ZN, 3ZO, 3ZP, 3ZQ, 3ZR, 3ZS, 3ZT, 3ZU, 3ZV, 3ZW, 3ZX, 3ZY, 3ZZ, 4AA, 4AB, 4AC, 4AD, 4AE, 4AF, 4AG, 4AH, 4AI, 4AJ, 4AK, 4AL, 4AM, 4AN, 4AO, 4AP, 4AQ, 4AR, 4AS, 4AT, 4AU, 4AV, 4AW, 4AX, 4AY, 4AZ, 5AA, 5AB, 5AC, 5AD, 5AE, 5AF, 5AG, 5AH, 5AI, 5AJ, 5AK, 5AL, 5AM, 5AN, 5AO, 5AP, 5AQ, 5AR, 5AS, 5AT, 5AU, 5AV, 5AW, 5AX, 5AY, 5AZ, 6AA, 6AB, 6AC, 6AD, 6AE, 6AF, 6AG, 6AH, 6AI, 6AJ, 6AK, 6AL, 6AM, 6AN, 6AO, 6AP, 6AQ, 6AR, 6AS, 6AT, 6AU, 6AV, 6AW, 6AX, 6AY, 6AZ, 7AA, 7AB, 7AC, 7AD, 7AE, 7AF, 7AG, 7AH, 7AI, 7AJ, 7AK, 7AL, 7AM, 7AN, 7AO, 7AP, 7AQ, 7AR, 7AS, 7AT, 7AU, 7AV, 7AW, 7AX, 7AY, 7AZ, 8AA, 8AB, 8AC, 8AD, 8AE, 8AF, 8AG, 8AH, 8AI, 8AJ, 8AK, 8AL, 8AM, 8AN, 8AO, 8AP, 8AQ, 8AR, 8AS, 8AT, 8AU, 8AV, 8AW, 8AX, 8AY, 8AZ, 9AA, 9AB, 9AC, 9AD, 9AE, 9AF, 9AG, 9AH, 9AI, 9AJ, 9AK, 9AL, 9AM, 9AN, 9AO, 9AP, 9AQ, 9AR, 9AS, 9AT, 9AU, 9AV, 9AW, 9AX, 9AY, 9AZ, 10AA, 10AB, 10AC, 10AD, 10AE, 10AF, 10AG, 10AH, 10AI, 10AJ, 10AK, 10AL, 10AM, 10AN, 10AO, 10AP, 10AQ, 10AR, 10AS, 10AT, 10AU, 10AV, 10AW, 10AX, 10AY, 10AZ, 11AA, 11AB, 11AC, 11AD, 11AE, 11AF, 11AG, 11AH, 11AI, 11AJ, 11AK, 11AL, 11AM, 11AN, 11AO, 11AP, 11AQ, 11AR, 11AS, 11AT, 11AU, 11AV, 11AW, 11AX, 11AY, 11AZ, 12AA, 12AB, 12AC, 12AD, 12AE, 12AF, 12AG, 12AH, 12AI, 12AJ, 12AK, 12AL, 12AM, 12AN, 12AO, 12AP, 12AQ, 12AR, 12AS, 12AT, 12AU, 12AV, 12AW, 12AX, 12AY, 12AZ, 13AA, 13AB, 13AC, 13AD, 13AE, 13AF, 13AG, 13AH, 13AI, 13AJ, 13AK, 13AL, 13AM, 13AN, 13AO, 13AP, 13AQ, 13AR, 13AS, 13AT, 13AU, 13AV, 13AW, 13AX, 13AY, 13AZ, 14AA, 14AB, 14AC, 14AD, 14AE, 14AF, 14AG, 14AH, 14AI, 14AJ, 14AK, 14AL, 14AM, 14AN, 14AO, 14AP, 14AQ, 14AR, 14AS, 14AT, 14AU, 14AV, 14AW, 14AX, 14AY, 14AZ, 15AA, 15AB, 15AC, 15AD, 15AE, 15AF, 15AG, 15AH, 15AI, 15AJ, 15AK, 15AL, 15AM, 15AN, 15AO, 15AP, 15AQ, 15AR, 15AS, 15AT, 15AU, 15AV, 15AW, 15AX, 15AY, 15AZ, 16AA, 16AB, 16AC, 16AD, 16AE, 16AF, 16AG, 16AH, 16AI, 16AJ, 16AK, 16AL, 16AM, 16AN, 16AO, 16AP, 16AQ, 16AR, 16AS, 16AT, 16AU, 16AV, 16AW, 16AX, 16AY, 16AZ, 17AA, 17AB, 17AC, 17AD, 17AE, 17AF, 17AG, 17AH, 17AI, 17AJ, 17AK, 17AL, 17AM, 17AN, 17AO, 17AP, 17AQ, 17AR, 17AS, 17AT, 17AU, 17AV, 17AW, 17AX, 17AY, 17AZ, 18AA, 18AB, 18AC, 18AD, 18AE, 18AF, 18AG, 18AH, 18AI, 18AJ, 18AK, 18AL, 18AM, 18AN, 18AO, 18AP, 18AQ, 18AR, 18AS, 18AT, 18AU, 18AV, 18AW, 18AX, 18AY, 18AZ, 19AA, 19AB, 19AC, 19AD, 19AE, 19AF, 19AG, 19AH, 19AI, 19AJ, 19AK, 19AL, 19AM, 19AN, 19AO, 19AP, 19AQ, 19AR, 19AS, 19AT, 19AU, 19AV, 19AW, 19AX, 19AY, 19AZ, 20AA, 20AB, 20AC, 20AD, 20AE, 20AF, 20AG, 20AH, 20AI, 20AJ, 20AK, 20AL, 20AM, 20AN, 20AO, 20AP, 20AQ, 20AR, 20AS, 20AT, 20AU, 20AV, 20AW, 20AX, 20AY, 20AZ, 21AA, 21AB, 21AC, 21AD, 21AE, 21AF, 21AG, 21AH, 21AI, 21AJ, 21AK, 21AL, 21AM, 21AN, 21AO, 21AP, 21AQ, 21AR, 21AS, 21AT, 21AU, 21AV, 21AW, 21AX, 21AY, 21AZ, 22AA, 22AB, 22AC, 22AD, 22AE, 22AF, 22AG, 22AH, 22AI, 22AJ, 22AK, 22AL, 22AM, 22AN, 22AO, 22AP, 22AQ, 22AR, 22AS, 22AT, 22AU, 22AV, 22AW, 22AX, 22AY, 22AZ, 23AA, 23AB, 23AC, 23AD, 23AE, 23AF, 23AG, 23AH, 23AI, 23AJ, 23AK, 23AL, 23AM, 23AN, 23AO, 23AP, 23AQ, 23AR, 23AS, 23AT, 23AU, 23AV, 23AW, 23AX, 23AY, 23AZ, 24AA, 24AB, 24AC, 24AD, 24AE, 24AF, 24AG, 24AH, 24AI, 24AJ, 24AK, 24AL, 24AM, 24AN, 24AO, 24AP, 24AQ, 24AR, 24AS, 24AT, 24AU, 24AV, 24AW, 24AX, 24AY, 24AZ, 25AA, 25AB, 25AC, 25AD, 25AE, 25AF, 25AG, 25AH, 25AI, 25AJ, 25AK, 25AL, 25AM, 25AN, 25AO, 25AP, 25AQ, 25AR, 25AS, 25AT, 25AU, 25AV, 25AW, 25AX, 25AY, 25AZ, 26AA, 26AB, 26AC, 26AD, 26AE, 26AF, 26AG, 26AH, 26AI, 26AJ, 26AK, 26AL, 26AM, 26AN, 26AO, 26AP, 26AQ, 26AR, 26AS, 26AT, 26AU, 26AV, 26AW, 26AX, 26AY, 26AZ, 27AA, 27AB, 27AC, 27AD, 27AE, 27AF, 27AG, 27AH, 27AI, 27AJ, 27AK, 27AL, 27AM, 27AN, 27AO, 27AP, 27AQ, 27AR, 27AS, 27AT, 27AU, 27AV, 27AW, 27AX, 27AY, 27AZ, 28AA, 28AB, 28AC, 28AD, 28AE, 28AF, 28AG, 28AH, 28AI, 28AJ, 28AK, 28AL, 28AM, 28AN, 28AO, 28AP, 28AQ, 28AR, 28AS, 28AT, 28AU, 28AV, 28AW, 28AX, 28AY, 28AZ, 29AA, 29AB, 29AC, 29AD, 29AE, 29AF, 29AG, 29AH, 29AI, 29AJ, 29AK, 29AL, 29AM, 29AN, 29AO, 29AP, 29AQ, 29AR, 29AS, 29AT, 29AU, 29AV, 29AW, 29AX, 29AY, 29AZ, 30AA, 30AB, 30AC, 30AD, 30AE, 30AF, 30AG, 30AH, 30AI, 30AJ, 30AK, 30AL, 30AM, 30AN, 30AO, 30AP, 30AQ, 30AR, 30AS, 30AT, 30AU, 30AV, 30AW, 30AX, 30AY, 30AZ, 31AA, 31AB, 31AC, 31AD, 31AE, 31AF, 31AG, 31AH, 31AI, 31AJ, 31AK, 31AL, 31AM, 31AN, 31AO, 31AP, 31AQ, 31AR, 31AS, 31AT, 31AU, 31AV, 31AW, 31AX, 31AY, 31AZ, 32AA, 32AB, 32AC, 32AD, 32AE, 32AF, 32AG, 32AH, 32AI, 32AJ, 32AK, 32AL, 32AM, 32AN, 32AO, 32AP, 32AQ, 32AR, 32AS, 32AT, 32AU, 32AV, 32AW, 32AX, 32AY, 32AZ, 33AA, 33AB, 33AC, 33AD, 33AE, 33AF, 33AG, 33AH, 33AI, 33AJ, 33AK, 33AL, 33AM, 33AN, 33AO, 33AP, 33AQ, 33AR, 33AS, 33AT, 33AU, 33AV, 33AW, 33AX, 33AY, 33AZ, 34AA, 34AB, 34AC, 34AD, 34AE, 34AF, 34AG, 34AH, 34AI, 34AJ, 34AK, 34AL, 34AM, 34AN, 34AO, 34AP, 34AQ, 34AR, 34AS, 34AT, 34AU, 34AV, 34AW, 34AX, 34AY, 34AZ, 35AA, 35AB, 35AC, 35AD, 35AE, 35AF, 35AG, 35AH, 35AI, 35AJ, 35AK, 35AL, 35AM, 35AN, 35AO, 35AP, 35AQ, 35AR, 35AS, 35AT, 35AU, 35AV, 35AW, 35AX, 35AY, 35AZ, 36AA, 36AB, 36AC, 36AD, 36AE, 36AF, 36AG, 36AH, 36AI, 36AJ, 36AK, 36AL, 36AM, 36AN, 36AO, 36AP, 36AQ, 36AR, 36AS, 36AT, 36AU, 36AV, 36AW, 36AX, 36AY, 36AZ, 37AA, 37AB, 37AC, 37AD, 37AE, 37AF, 37AG, 37AH, 37AI, 37AJ, 37AK, 37AL, 37AM, 37AN, 37AO, 37AP, 37AQ, 37AR, 37AS, 37AT, 37AU, 37AV, 37AW, 37AX, 37AY, 37AZ, 38AA, 38AB, 38AC, 38AD, 38AE, 38AF, 38AG, 38AH, 38AI, 38AJ, 38AK, 38AL, 38AM, 38AN, 38AO, 38AP, 38AQ, 38AR, 38AS, 38AT, 38AU, 38AV, 38AW, 38AX, 38AY, 38AZ, 39AA, 39AB, 39AC, 39AD, 39AE, 39AF, 39AG, 39AH, 39AI, 39AJ, 39AK, 39AL, 39AM, 39AN, 39AO, 39AP, 39AQ, 39AR, 39AS, 39AT, 39AU, 39AV, 39AW, 39AX, 39AY, 39AZ, 40AA, 40AB, 40AC, 40AD, 40AE, 40AF, 40AG, 40AH, 40AI, 40AJ, 40AK, 40AL, 40AM, 40AN, 40AO, 40AP, 40AQ, 40AR, 40AS, 40AT, 40AU, 40AV, 40AW, 40AX, 40AY, 40AZ, 41AA, 41AB, 41AC, 41AD, 41AE, 41AF, 41AG, 41AH, 41AI, 41AJ, 41AK, 41AL, 41AM, 41AN, 41AO, 41AP, 41AQ, 41AR, 41AS, 41AT, 41AU, 41AV, 41AW, 41AX, 41AY, 41AZ, 42AA, 42AB, 42AC, 42AD, 42AE, 42AF, 42AG, 42AH, 42AI, 42AJ, 42AK, 42AL, 42AM, 42AN, 42AO, 42AP, 42AQ, 42AR, 42AS, 42AT, 42AU, 42AV, 42AW, 42AX, 42AY, 42AZ, 43AA, 43AB, 43AC, 43AD, 43AE, 43AF, 43AG, 43AH, 43AI, 43AJ, 43AK, 43AL, 43AM, 43AN, 43AO, 43AP, 43AQ, 43AR, 43AS, 43AT, 43AU, 43AV, 43AW, 43AX, 43AY, 43AZ, 44AA, 44AB, 44AC, 44AD, 44AE, 44AF, 44AG, 44AH, 44AI, 44AJ, 44AK, 44AL, 44AM, 44AN, 44AO, 44AP, 44AQ, 44AR, 44AS, 44AT, 44AU, 44AV, 44AW, 44AX, 44AY, 44AZ, 45AA, 45AB, 45AC, 45AD, 45AE, 45AF, 45AG, 45AH, 45AI, 45AJ, 45AK, 45AL, 45AM, 45AN, 45AO, 45AP, 45AQ, 45AR, 45AS, 45AT, 45AU, 45AV, 45AW, 45AX, 45AY, 45AZ, 46AA, 46AB, 46AC, 46AD, 46AE, 46AF, 46AG, 46AH, 46AI, 46AJ, 46AK, 46AL, 46AM, 46AN, 46AO, 46AP, 46AQ, 46AR, 46AS, 46AT, 46AU, 46AV, 46AW, 46AX, 46AY, 46AZ, 47AA, 47AB, 47AC, 47AD, 47AE, 47AF, 47AG, 47AH, 47AI, 47AJ, 47AK, 47AL, 47AM, 47AN, 47AO, 47AP, 47AQ, 47AR, 47AS, 47AT, 47AU, 47AV, 47AW, 47AX, 47AY, 47AZ, 48AA, 48AB, 48AC, 48AD, 48AE, 48AF, 48AG, 48AH, 48AI, 48AJ, 48AK, 48AL, 48AM, 48AN, 48AO, 48AP, 48AQ, 48AR, 48AS, 48AT, 48AU, 48AV, 48AW, 48AX, 48AY, 48AZ, 49AA, 49AB, 49AC, 49AD, 49AE, 49AF, 49AG, 49AH, 49AI, 49AJ, 49AK, 49AL, 49AM, 49AN, 49AO, 49AP, 49AQ, 49AR, 49AS, 49AT, 49AU, 49AV, 49AW, 49AX, 49AY, 49AZ, 50AA, 50AB, 50AC, 50AD, 50AE, 50AF, 50AG, 50AH, 50AI, 50AJ, 50AK, 50AL, 50AM, 50AN, 50AO, 50AP, 50AQ, 50AR, 50AS, 50AT, 50AU, 50AV, 50AW, 50AX, 50AY, 50AZ, 51AA, 51AB, 51AC, 51AD, 51AE, 51AF, 51AG, 51AH, 51AI, 51AJ, 51AK, 51AL, 51AM, 51AN, 51AO, 51AP, 51AQ, 51AR, 51AS, 51AT, 51AU, 51AV, 51AW, 51AX, 51AY, 51AZ, 52AA, 52AB, 52AC, 52AD, 52AE, 52AF, 52AG, 52AH, 52AI, 52AJ, 52AK, 52AL, 52AM, 52AN, 52AO, 52AP, 52AQ, 52AR, 52AS, 52AT, 52AU, 52AV, 52AW, 52AX, 52AY, 52AZ, 53AA, 53AB, 53AC, 53AD, 53AE, 53AF, 53AG, 53AH, 53AI, 53AJ, 53AK, 53AL, 53AM, 53AN, 53AO, 53AP, 53AQ, 53AR, 53AS, 53AT, 53AU, 53AV, 53AW, 53AX, 53AY, 53AZ, 54AA, 54AB, 54AC, 54AD, 54AE, 54AF, 54AG, 54AH, 54AI, 54AJ, 54AK, 54AL, 54AM, 54AN, 54AO, 54AP, 54AQ, 54AR, 54AS, 54AT, 54AU, 54AV, 54AW, 54AX, 54AY, 54AZ, 55AA, 55AB, 55AC, 55AD, 55AE, 55AF, 55AG, 55AH, 55AI, 55AJ, 55AK, 55AL, 55AM, 55AN, 55AO, 55AP, 55AQ, 55AR, 55AS, 55AT, 55AU, 55AV, 55AW, 55AX, 55AY, 55AZ, 56AA, 56AB, 56AC, 56AD, 56AE, 56AF, 56AG, 56AH, 56AI, 56AJ, 56AK, 56AL, 56AM, 56AN, 56AO, 56AP, 56AQ, 56AR, 56AS, 56AT, 56AU, 56AV, 56AW, 56AX, 56AY, 56AZ, 57AA, 57AB, 57AC, 57AD, 57AE, 57AF, 57AG, 57AH, 57AI, 57AJ, 57AK, 57AL, 57AM, 57AN, 57AO, 57AP, 57AQ, 57AR, 57AS, 57AT, 57AU, 57AV, 57AW, 57AX, 57AY, 57AZ, 58AA, 58AB, 58AC, 58AD, 58AE, 58AF, 58AG, 58AH, 58AI, 58AJ, 58AK, 58AL, 58AM, 58AN, 58AO, 58AP, 58AQ, 58AR, 58AS, 58AT, 58AU, 58AV, 58AW, 58AX, 58AY, 58AZ, 59AA, 59AB, 59AC, 59AD, 59AE, 59AF, 59AG, 59AH, 59AI, 59AJ, 59AK, 59AL, 59AM, 59AN, 59AO, 59AP, 59AQ, 59AR, 59AS, 59AT, 59AU, 59AV, 59AW, 59AX, 59AY, 59AZ, 60AA, 60AB, 60AC, 60AD, 60AE, 60AF, 60AG, 60AH, 60AI, 60AJ, 60AK, 60AL, 60AM, 60AN, 60AO, 60AP, 60AQ, 60AR, 60AS, 60AT, 60AU, 60AV, 60AW, 60AX, 60AY, 60AZ, 61AA, 61AB, 61AC, 61AD, 61AE, 61AF, 61AG, 61AH, 61AI, 61AJ, 61AK, 61AL, 61AM, 61AN, 61AO, 61AP, 61AQ, 61AR, 61AS, 61AT, 61AU, 61AV, 61AW, 61AX, 61AY, 61AZ, 62AA, 62AB, 62AC, 62AD, 62AE, 62AF, 62AG, 62AH, 62AI, 62AJ, 62AK, 62AL, 62AM, 62AN, 62AO, 62AP, 62AQ, 62AR, 62AS, 62AT, 62AU, 62AV, 62AW, 62AX, 62AY, 62AZ, 63AA, 63AB, 63AC, 63AD, 63AE, 63AF, 63AG, 63AH, 63AI, 63AJ, 63AK, 63AL, 63AM, 63AN, 63AO, 63AP, 63AQ, 63AR, 63AS, 63AT, 63AU, 63AV, 63AW, 63AX, 63AY, 63AZ, 64AA, 64AB, 64AC, 64AD, 64AE, 64AF, 64AG, 64AH, 64AI, 64AJ, 64AK, 64AL, 64AM, 64AN, 64AO, 64AP, 64AQ, 64AR, 64AS, 64AT, 64AU, 64AV, 64AW, 64AX, 64AY, 64AZ, 65AA, 65AB, 65AC, 65AD, 65AE, 65AF, 65AG, 65AH, 65AI, 65AJ, 65AK, 65AL, 65AM, 65AN, 65AO, 65AP, 65AQ, 65AR, 65AS, 65AT, 65AU, 65AV, 65AW, 65AX, 65AY, 65AZ, 66AA, 66AB, 66AC, 66AD, 66AE, 66AF, 66AG, 66AH, 66AI, 66AJ, 66AK, 66AL, 66AM, 66AN, 66AO, 66AP, 66AQ, 66AR, 66AS, 66AT, 66AU, 66AV, 66AW, 66AX, 66AY, 66AZ, 67AA, 67AB, 67AC, 67AD, 67AE, 67AF, 67AG, 67AH, 67AI, 67AJ, 67AK, 67AL, 67AM, 67AN, 67AO, 67AP, 67AQ, 67AR, 67AS, 67AT, 67AU, 67AV, 67AW, 67AX, 67AY, 67AZ, 68AA, 68AB, 68AC, 68AD, 68AE, 68AF, 68AG, 68AH, 68AI, 68AJ, 68AK, 68AL, 68AM, 68AN, 68AO, 68AP, 68AQ, 68AR, 68AS, 68AT, 68AU, 68AV, 68AW, 68AX, 68AY, 68AZ, 69AA, 69AB, 69AC, 69AD, 69AE, 69AF, 69AG, 69AH, 69AI, 69AJ, 69AK, 69AL, 69AM, 69AN, 69AO, 69AP, 69AQ, 69AR, 69AS, 69AT, 69AU, 69AV, 69AW, 69AX, 69AY, 69AZ, 70AA, 70AB, 70AC, 70AD, 70AE, 70AF, 70AG, 70AH, 70AI, 70AJ, 70AK, 70AL, 70AM, 70AN, 70AO, 70AP, 70AQ, 70AR, 70AS, 70AT, 70AU, 70AV, 70AW, 70AX, 70AY, 70AZ, 71AA, 71AB, 71AC, 71AD, 71AE, 71AF, 71AG, 71AH, 71AI, 71AJ, 71AK, 71AL, 71AM, 71AN, 71AO, 71AP, 71AQ, 71AR, 71AS, 71AT, 71AU, 71AV, 71AW, 71AX, 71AY, 71AZ, 72AA, 72AB, 72AC, 72AD, 72AE, 72AF, 72AG, 72AH, 72AI, 72AJ, 72AK, 72AL, 72AM, 72AN, 72AO, 72AP, 72AQ, 72AR, 72AS, 72AT, 72AU, 72AV, 72AW, 72AX, 72AY, 72AZ, 73AA, 73AB, 73AC, 73AD, 73AE, 73AF, 73AG, 73AH, 73AI, 73AJ, 73AK, 73AL, 73AM, 73AN, 73AO, 73AP, 73AQ, 73AR, 73AS, 73AT, 73AU, 73AV, 73AW, 73AX, 73AY, 73AZ, 74AA, 74AB, 74AC, 74AD, 74AE, 74AF, 74AG, 74AH, 74AI, 74AJ, 74AK, 74AL, 74AM, 74AN, 74AO, 74AP, 74AQ, 74AR, 74AS, 74AT, 74AU, 74AV, 74AW, 74AX, 74AY, 74AZ, 75AA, 75AB, 75AC, 75AD, 75AE, 75AF, 75AG, 75AH, 75AI, 75AJ, 75AK, 75AL, 75AM, 75AN, 75AO, 75AP, 75AQ, 75AR, 75AS, 75AT, 75AU, 75AV, 75AW, 75AX, 75AY, 75AZ, 76AA, 76AB, 76AC, 76AD, 76AE, 76AF, 76AG, 76AH, 76AI, 76AJ, 76AK, 76AL, 76AM, 76AN, 76AO, 76AP, 76AQ, 76AR, 76AS, 76AT, 76AU, 76AV, 76AW, 76AX, 76AY, 76AZ, 77AA, 77AB, 77AC, 77AD, 77AE, 77AF, 77AG, 77AH, 77AI, 77AJ, 77AK, 77AL, 77AM, 77AN, 77AO, 77AP, 77AQ, 77AR, 77AS, 77AT, 77AU, 77AV, 77AW, 77AX, 77AY, 77AZ, 78AA, 78AB, 78AC, 78AD, 78AE, 78AF, 78AG, 78AH, 78AI, 78AJ, 78AK, 78AL, 78AM, 78AN, 78AO, 78AP, 78AQ, 78AR, 78AS, 78AT, 78AU, 78AV, 78AW, 78AX, 78AY, 78AZ, 79AA, 79AB, 79AC, 79AD, 79AE, 79AF, 79AG, 79AH, 79AI, 79AJ, 79AK, 79AL, 79AM, 79AN, 79AO, 79AP, 79AQ, 79AR, 79AS, 79AT, 79AU, 79AV, 79AW, 79AX, 79AY, 79AZ, 80AA, 80AB, 80AC, 80AD, 80AE, 80AF, 80AG, 80AH, 80AI, 80AJ, 80AK, 80AL, 80AM, 80AN, 80AO, 80AP, 80AQ, 80AR, 80AS, 80AT, 80AU, 80AV, 80AW, 80AX, 80AY, 80AZ, 81AA, 81AB, 81AC, 81AD, 81AE, 81AF, 81AG, 81AH, 81AI, 81AJ, 81AK, 81AL, 81AM, 81AN, 81AO, 81AP, 81AQ, 81AR, 81AS,

4EA, 4EL, 4FD, 4FP, 4GN, 4IW, 5DA, 5IR, 5XA, 5AFA, 5AFB, 5AFD, 5AGA, 5AGE, 5AHE, 5AHQ, 5AHV, 5AIO, 5AJT, 5AJX, 5ANO, 5ARB, 5ARD, 5ASL, 5AUO, 5AUX, 5AXN, 5AXO, 5AYC, 5AZF, 5BAZ, 5BDK, 5BDP, 5BEP, 5BRL, 5BUH, 5BUQ, 5BXC, 5CHV, 5DB, 5DL, 5DV, 5EA, 5EB, 5EO, 5EW, 5HS, 5HW, 5JJ, 5KN, 5KY, 5LB, 5NQ, 5RQ, 5TK, 5UC, 5VE, 5VQ, 5VY, 5VW, 5WD, 5WE, 5WR, 5WU, 5WV, 5WZ, 5ZW, 5AAW, 5AGB, 5AGF, 5AIF, 5AIR, 5ARR, 5AZE, 5AZF, 5DSD, 5DZY, 5MC, 5MY, 5OX, 5UH, 5UK, 5UL, 5US, 5XI, 5YC, 5ZJ, Can. 3BP, 3GN, 3GX, 3JI.

C.W.: 1ADL, 1AGI, 1AIP, 1AJP, 1ARY, 1AVI, 1AZW, 1BDC, 1BES, 1BET, 1BGC, 1BKE, 1BKQ, 1BTL, 1BWJ, 1BYK, 1CJH, 1CKQ, 1CMK, 1CNF, 1IL, 1IV, 1PR, 1PT, 1RD, 1YB, 1YK, 1ZE, 2AAB, 2AEH, 2AFP, 2APB, 2AQH, 2AQU, 2AWF, 2AWJ, 2AYV, 2AZZ, 2BAK, 2BEA, 2BEH, 2BEK, 2BGN, 2BMA, 2BML, 2BNZ, 2BQV, 2BRC, 2BXR, 2BXY, 2BZA, 2BZV, 2CCD, 2CCL, 2CCX, 2CFT, 2CGQ, 2CIC, 2DK, 2DX, 2FP, 2KP, 2NZ, 2SQ, 2RY, 2VC, 2WI, 2XJ fone, 2ZH fone, 2ZK fone, 2ZL, 3AAE, 3AAY, 3AGD, 3AGI, 3AJD, 3ANY, 3APG, 3AQH, 3AQR, 3AXP, 3BG, 3BHL, 3BIJ, 3BNU, 3BTI, 3BUR, 3BUV, 3BVA, 3BZ, 3CA, 3DM, 3EM, 3HG, 3IV, 3JH, 3LC, 3NH, 3OZ, 3QV, 3RM, 3YE, 3ZN, 3ZO fone & C.W., 3ZZ, 4BL, 4BY, 4DC, 4EH, 4GL, 4GX, 4IL, 4JH, 4LF, 4DL, 4YA, 4ZC, 4ZL, 5DA, 5LA, 5WO, 5ANZ, 6EY, 8AGO, 8AHM, 8AIO, 8AJU, 8ALB, 8ALG, 8ALT, 8ANJ, 8AJO, 8APB, 8AQO, 8AQU, 8ARK, 8ASO, 8AUO, 8AVA, 8AVL, 8AWM, 8AWP, 8AWS, 8AWX, 8AX, 8AXC, 8BCQ, 8BDF, 8BDU, 8BFX, 8BIL, 8BK, 8BKE, 8BKZ, 8BLX, 8BMF, 8BNU, 8BOX, 8BPL, 8BSS, 8BUM, 8BUX, 8BZY, 8CAZ, 8CBJ, 8CKM, 8CMM, 8CNA, 8COO, 8DV, 8ML, 8MO, 8NV, 8PT, 8QZ, 8RF, 8RQ, 8SE, 8SP, 8UK, 8VJ, 8VQ, 8VR, 8WR, 8XA, 8XE, 8ZAE, 8ZZ, 9AIY, 9AJA, 9AMB, 9ARK, 9AXR, 9BKY, 9DIO, 9DOF, 9EI, 9IL, 9IO, 9KM, 9UZ, 9WA, Can. 3BP, 3JI.

### 3BLF, Richmond, Va.

C.W.: 1AGI, (1ASF), (1AZW), (1BAS), (1BBW), 1CHJ, (1CIK), 1PR, (1PT), (1QP), 1VQ, (1XK), 1YB, (1YK), (2AAB), (2ACQ), 2AFP, (2AIF), 2AYV, 2BEM, 2BEA, (2BGI), 2BML, (2BLP), (2BQH), (2BQM), 2BYC, 2CCD, 2DK, 2FP, 2SQ, 2ADT, 3AEH, 3AEV, 3AJD, (3ALN), (3ALL), (3ANY), (3AQH), 3AWH, Can. 3AZ, 3BA, 3BEC, 3BHL, 3BZ, (3CA), 3CXA, (Can. 3CZ), (3FM), 3FS, 3GH, (3HG), 3HW, 3NB, (3QV), 3UX, 3VW, (3ZO), 3ZY, 4BF, 4BY, 4CA, 4DM, 4GL, (4II), (4JH), 4KC, 4LP, 4ZC, 5EK, 5JB, 5OI, 6ZF, 6ZZ, (8AFE), 8AGO, 8AIG, (8AMD), (8ANB), (8APB), (8ARW), (8AUX), 8AVD, 8AWM, 8AXC, 8AXB, 8AVL, 8BCL, (8BDB), 8BEX, (8BJC), 8BKE, 8BLX, 8BNU, (8BO), (8QZ), 8BXH, (8BZY), (8CNA), (8CON), (8COO), 8DV, 8CMM, 8HJ, (8HM), (8LB), 8OZ, (8QZ), (8QB), (8VY), 8WR, 8XAE fone, 8XE fone, 9AGH, 9AIY, (9AJH), 9AAP, 9ANE, 9APH, 9BED, 9BIK, 9BJB, 9CBA, 9CT, 9DCG, 9DGO, 9DOF, (9EI), 9FM, (9II), (9IL), (9IO), 9PF, (9QF), 9UC, 9WQ, 9XI, 9XM fone, 9ZAF.

### Ed & A. Burg, Washington, D. C.

C.W.: 1ADL, 1ARY, 1AZW, 1BBW, 1BKA fone, 1BKQ, 1BLE, 1BQE, 1BWJ, 1CIK, 1HK, 1IL, 1JT, 1PT, 1PR, 1QP, 1SQ, 1XZ, 2AAB, 2AJR, 2BCF, 2BEA, 2BEH, 2BEM, 2BNZ, 2BQU, 2BUM, 2BSC, 2CCD, 2DK, 2FP, 2QZ, 2RM, 2XI fone, 2XJ fone, 2ZK fone, 2ZL, 3AAD, 3AFU, 3ALN, 3BU, 3BUY, 3BOF, 3BSP, 3BXA, 3CM, 3IL, 3IW, 3QV, 3RF, 3TR, 3XL, 3ZP, 3ZY, 4FD, 4DQ, 4GH, 4GL, 4IV, 4PL, 4ZC, 5DO, 5EK, 5NT, 5PJ, 5WU, 5ZA fone, 6ZAC (Heard also by 3ALN), 8ADQ, 8AGO, 8ALT, 8AQZ, 8AR, 8ARK, 8ARO, 8AUY, 8AWM, 8AWQ, 8AX, 8BAE, 8BDU, 8BKE, 8BLW, 8BLX, 8BO, 8BWK, 8BXC, 8BFX, 8BK, 8BFX, 8BSS, 8BQV, 8CAM, 8CEZ, 8CFP, 8CHV, 8CO, 8DV, 8GA, 8GW, 8HZ, 8LB, 8LQ, 8LK, 8PT, 8QZ, 8RQ, 8UK, 8XE, 8VY, 8YD, 8ZA, 8ZAE, 8AAR, 8AIY, 8ANE, 8AOU, 8APH, 8ARK, 8ARZ, 8BBU, 8BEO, 8BIK, 8BP, 8BPC, 8BPO, 8BSG, 8BTA, 8BYA, 8CT, 8CMM, 8DGO, 8DZQ, 9EI, 9FZ, 9HJ, 9IL, 9IJ, 9IL, 9RS, 9TU, 9WQ, 9XI, 9XM fone, 9ZAF.

Spark: 1AA, 1ARY, 1AW, 1AZB, 1BVB, 1CID, 1CNI, 2AHU, 2AJ, 2AJE, 2AQI, 2BSC, 2DM, 2EL, 2PU, 2TF, 3AAD, 3ABB, 3ALN, 3ARW, 3ARO,

3ASO, 3BJ, 3CT, 3GX, 3HJ, 3OK, 3PU, 3PZ, 4CX, 5ACF, 5AHH, 5AWY, 5AXY, 5AHQ, 5BAZ, 5CEZ, 5CH, 5EO, 5EW, 5IN, 5JJ, 5LB, 5OW, 5RQ, 5VQ, 5XE, 5AAW, 5ACB, 5AHY, 5ARG, 5AUL, 5AXF, 5AZA, 5BAS, 5CA, 5DMJ, 5EM, 5JJ, 5MC, 5UH, 5UU, 5YB, 5ZB, 5ZC, 5ZJ.

### 4EZq Jacksonville, Fla.

Spark: 2EL, 2FP, (2JZ), 2ABB, 3AJD, 3AOV, 3ARN, (4AS), (4BC), (4BI), (4CX), (4DQ), 4DZ, 4EA, (4FD), (4GN), (4HS), (4HW), (4IX), 4SK, 4YA, 5GI, 4HK, 5PE, 5QS, 5UE, (5XA), 5ABY, 5IN, 5RQ, 5SP, 5UC, 5WD, (5ZO), 5ACB, 5AFD, 5AIZ, (5AJV), 5AWU, 5AXB, (5BAZ), 5BFY, 5BRL, (5CPC), 5LF, 5VL, 5ARR, 5ASJ.

C.W.: 1BDC, 2FP, 2CFT, 3BZ, 3CA, 3IL, 4AS, 4AZ, 4BF, 4DC, 4DS, 4EN, 4GL, 4GX, 4II, 4IV, 4KL, 4KM, 5DA, 5KU, 5LA, 5XA, 5EN, 5HM, 5SP, 5XE, 5ANB, 5BYE, 5BHD, 5BLO, 5DYN.

### No "Fives"

No calls were received from the Fifth District and but few from the Fourth. "Smatter"—static got you fellows on the run? Come on wid sum lists.—Ed.

### 6AOR, Berkeley, Calif.

Spark: (6FH), 6GT, 6GD, (6HY), 6IC, (6IV), (6KE), 6LK, 6OD, (6WG), (6AAK), (6AEH), 6AGK, (6AHF), 6AHQ, (6AIN), 6AJO, (6AJH), 6AJR, (6AKL), (6AMN), 6ARK, (6AVD), (6AWI), (6BAJ), (6BDZ), (6BMP), (7BJ), 7BH, (7BK), 7ED, 7HN, (7HF), 7KE, (7KJ), 7GJ, (7GQ), 7GT, 7MF, 7MU, 7OT, (7OZ), 7TQ.

C.W.: 5ZA, (6CU), 6EN, 6JD, 6KA, 6GY, (6GD), (6BES), 6ZA, 6ZX, 6ZZ, 6XAD, 6ZAC, 7RN, 7NF, 7QT, 7WE, 7XF, 8AGZ, 8AIM, 9ANF, 9AMB.

### 6AWP, Santa Ana, Calif.

C.W.: 2FP, 3FS, 3ALN, 4BQ, 4FT, Can. 4CB, (5ZA), 6AIF, (6AK), (6AKW), (6ALE), (6ASJ), (6AUN), (6AWT), (6BKB), 6DF, 6FH, 6GH, 6IB, (6KC), 6KU, 6NN, 6NX, (6TW), (6XAD), 6XH, (6ZA), 6ZAC, 6ZAE, 6ZAF, (6ZB), (6ZF), 6ZG, (6ZN), 6ZI, (6ZT), (6ZZ), (7DP), 7NF, 7NI, (7OZ), 7XF, (7ZU), 8AGZ, 8BRL, 8JL, 8XV, 9AAV, 9AEG, 9ALG, 9AOG, 9AJS, (9AMB), 9ARJ, Can. 9BD, (9BJI), 9BSG, (9DTH), (9DTM), (9DVA), 9DXN, 9DZJ, 9NX, (9PS), (9WD), (9WU), (9XAQ), 9XM, 9YAE, (9ZAC), (CL8), D5, phone, XF1.

Spark: 5IF, 5HK, 5XD, 5XU, 5XQ, (5ZA), 6's too numerous, 7BS, 7CB, 7CK, 7GJ, 7GT, 7HF, 7IM, 7IN, 7JD, 7KB, (7LY), 7MF, 7MP, 7NF, (7OT), 7TJ, 7VD, 7WJ, 7XV, (7YA), 7YJ, 7YS, 7ZA, 7ZM, 7ZO, 7ZU, 9AEG, 9AQQ, 9AYU.

### 6ASN, Berkeley, Cal.

5IG, 5BY, 6GT, 6HR, 6HY, 6IV, 6KC, 6LC, 6OL, 6OD, 6OM, 6QR, 6ZM, 6ZZ, 6AAK, 6AAT, (6ACA), 6AEH, 6AEG, 6AHQ, 6AKV, 6AKL, 6AIN, 6AMN, 6AVR, 6AWE, 6ZAG, 6BJV, 7BH, 7BK, 7GR, 7KE, 7MF, 7OG, 7MW, 7OT, 7SN, 7WG, 7WO, 7YA, 7ZM, CL8.

### 6OL, Glendale, Calif.—Spark

Worked: 5ZA, 6AH, 6AK, 6AR, 6AS, 6CP, 6EX, 6FH, 6GF, 6GR, 6GT, 6GX, 6HC, 6IB, 6IC, 6IM, 6KC, 6KM, 6MZ, 6NG, 6OC, 6OH, 6PJ, 6PO, 6PR, 6QK, 6QR, 6QT, 6SK, 6TC, 6TU, 6UQ, 6VK, 6VX, 6WG, 6XH, 6ZB, 6ZI, 6ZU, 6ZX, 6ZZ, 6AAH, 6AAK, 6ABK, 6ABM, 6ABW, 6ADA, 6AEH, 6AEI, 6AFP, 6AGF, 6AID, 6AII, 6AJH, 6AJR, 6AKL, 6ANG, 6APH, 6AQU, 6ARK, 6ARW, 6ATQ, 6AUD, 6AUU, 6AVX, 6BGL, 6BIU, 6BJV, 6BNN, 7MF, 7TO.

Heard: 5OF, 5XD, 6BM, 6FK, 6GK, 6NO, 6TO, 6TV, 6VZ, 6AAU, 6ABX, 6ACR, 6ACW, 6AFN, 6AFY, 6AHV, 6AIF, 6AIN, 6ALV, 6ANR, 6ST, 6ATH, 6ATU, 6ATY, 6AUC, 6AUP, 6AVB, 6AWH, 6BCJ, 6BCZ, 6ZD, 6ZAM, 7ED, 7BK, 7BP, 7CN, 7GJ, 7IN, 7IW, 7JD, 7KE, 7KB, 7KS, 7MU, 7TJ, 7ZT, 7ZV.

### Assa S. Keller, Monroe, Wash.—One Tube

Spark: 5AK, 5CN, 6AJR, 6ARK, 6GR, 6KM, 6TU, 6VA, 7AGG, 7ACN, 7AS, 7BB, 7BK, 7BE, 7BK, 7CU, 7ED, 7FI, 7FR, 7GE, 7GJ, 7HD, 7IW, 7TJ, 7JD, 7JF, 7JW, 7KJ, 7LY, 7MF, 7MU, 7NN,

7NW, 7NZ, 7OT, 7OZ, 7TG, 7TO, 7WG, 7YL, 7YS, 7ZV.

C.W.: 4IS, 5CT, 5WM, 5ZA, 6AAT, 6ADM, 6AIB, 6AK, 6AW, 6AWP, 6AWT, 6BCD, 6BGE, 6EN, 6FH, 6GY, 6KA, 6KI, 6KU, 6NX, 6OO, 6TW, 6VM, 6ZAD, 6ZF, 6ZI, 6ZX, 7BS dalite, 7DP, 7HI, 7HS, 7MF, 7NA, 7NC, 7NF, 7NN, 7QT, 7RN, 7SO, 7WE, 7ZU, 9AMB, 9AYU, 9BBF, 9BJI, 9PI, 9PS, 9WU, 9XAG, CL2, Can. 4CB fone, 6KU, 7RN, 7ZU.

#### 7ACS, Tekoa, Wash.

Spark: 6AFD, 6AJR, 6ALU, 6AWS, 6LX, 6GF, 6KM, 6ZA, 6ZAM, 6ZQ, 6ZAE, 7BF, 7BH, 7BK, 7FQ, 7FR, 7GE, 7JD, 7JF, 7KJ, 7LY, 7MF, 7NW, 7NZ, 7TG, 7XB, 7YA, 7YL, 7ZM, 7ZK, CLS, Can. 9BD.

C.W.: 6AIB, 6AWP, 6BES, 6EA, 6FF, 6KA, 6KI, 6KU, 6NX, 6XAD, 6XAC, 6XAG, 6XF, 6ZAE, 6ZAC, 6ZF, 6ZG, 6ZI, 6ZN, 6ZR, 6ZX, 6ZZ, 7BG, 7DP, 7FL, 7NA, 7NN, 7QC, 7SC, 7XG, 7ZU, CLS, 9AMG, 9ASF, 9ASU, 9DVA, 9DVJ, 9DZG, 9QF, 9TI, 9WU, 9XAG, 9XI, 9YAJ, 9YAW, 9ZAF, 9ZF, Can. 4CB, 4BV, 9BD.

#### Ridgfield, Ph. N. J.—Indoor Aerial, 1 Tube

C.W.: 1ABY, 1PR, 1XM, 2AYV, 2BGI, 2BC, 2ANG, 2BLF, 2BZ, 2NH, 2VW, 4DC, 4GL, 4GX, 5ADG, 5AIO, 5AVL, 5AWY, 5BDO, 5BLX, 5BXH, 5KH, 5SE, 5XE.

#### Robert Whitmer, Battle Creek, Mich.

C.W.: 1AGW, 1AIP, 1BLE, 1IZ, 1JT, 2AY, 2BHA, 2BEN, 2BES, 2BSL, 2BYH, 2CC, 2KPG, 2ALL, 2AQS, 2BES, 2BHP, 2IW, 2KJP, 2RF, 4ANY, 4BQC, 4BY, 4IU, 4KA, 4KC, 4TQ, 4VW, 5FIM, 5FS, 5FU, 5QH, 5ZY, 5ANB, 5AWM, 5AWX, 5BIT, 5BKE, 5BLW, 5BNK, 5BU, 5BVX, 5BWK, 5BWS, 5CAY, 5CIA, 5CIH, 5CLS, 5CQ, 5CQL, 5CTZ, 5CV, 5DDD, 5DV, 5PT, 5QTC, 5SE, 5UK, 5VQ, 5VY, 5XE, 5ZAE, 5ZF, 5YAI, 5AJS, 5AO, 5AOU, 5ARK, 5AVA, 5BBF, 5BGD, 5BHI, 5BLC, 5BLO, 5BF, 5DA, 5DZH, 5DWS, 5DZQ, 5EI, 5GL, 5GLC, 5II, 5IIV, 5IJS, 5IL, 5IO, 5JO, 5LG, 5LO, 5PEF, 5YAM, 5Spark: 5AYX, 5AZF, 5CF, 5CA, 5EB, 5JJ, 5LB, 5NZ, 5RT, 5WD, 5YN, 5ZA, 5ZO, 5BAK, 5BSQ, 5DDZ, 5DGX, 5JX, 5TK.

#### SBKE, Huntington, W. Va.

C.W.: 1QP, (1XZ), 1ZE, 1AZW, 1BRQ, 1CNE, 1XAD, 2WR, (2WT), 2VC, 2AAB, 2AFP, 2ANJ, 2AXK, (2BFX), 2CBG, 2CCD, 2CFT, (3BA), 3BG, 3BZ, 3FS, 3GH, (3IW), 3IZ, 3QV, 3ZO, (3AAD), 3ANY, (3BIJ), (3BOF), 4BY, (4EB), (4EH), 4FF, (4GH), 4GL, 4GS, 4HB, (4II), 4IV, (4LP), 5BO, (5DO), 5EK, (5FO), 5FV, 5IJ, 5OI, 5RL, 5ZA, 5ABM, 5BO, 5BU, 5EA, 5FT, 5GV, 5GZ, 5HJ, 5LW, 5PN, (5PT), (5QB), 5QZ, 5SP, 5VJ, 5VY, (5WR), 5XE, (5YM), 5ABM, 5AGG, (5AGO), 5AIM, (5AIO), (5ALB), (5ANB), 5AQF, (5ARK), (5ARU), (5ASM), 5AUX, 5AVW, 5AWM, (5AWY), 5AXB, 5AXC, 5BCA, 5BCL, 5BDB, 5BEK, 5BGD, 5BGJ, (5BLW), 5BLT, (5BPU), 5BQF, 5BQU, 5BRL, (5BUX), 5CII, 5CLD, (5CPF), 5XAK, 5ZAE, 5AL, (5CT), 5DG, 5DX, (5EI), 5FM, 5II, (5IL), 5IO, 5IP, 5KE, (5KM), 5KP, 5KT, (5LE), (5LQ), 5PE, 5PC, (5PI), 5PS, (5SJ), 5SL, (5SO), 5VK, 5WQ, (5WU), (5XI), (5ZL), (5AAP), 5AAY, 5ABG, 5ABQ, (5AFN), 5AII, 5AJA, (5AJH), 5AOU, 5ARX, (5AREZ), (5ASL), 5AUM, 5AVN, (5AXF), (5BCT), 5BED, (5BIK), (5BJR), (5DGG), 5DKY, (5DOF), 5DSM, 5DZQ, (5CBA), 5CDA.

#### SBWC, Rome, N. Y.

Spark: 1AA, 1AW, 1CK, 1GA, 1GM, 1LZ, 1QO, 1RQ, 1RV, 1RX, 1SN, 1YB, 1YB, 1ACO, 1AHF, 1AKG, 1AMZ, 1ARY, 1ASF, 1AZJ, 1AZK, 1BCF, 1BAC, 1BQA, 1BRQ, 1BVB, 1BWJ, 1CJA, 1CKS, 1CNI, 1COK, 2DI, 2CT, 2EL, 2EU, 2FP, 2QN, 2RM, 2SU, 2SZ, 2TA, 2TF, 2AHU, 2AJE, 2AQI, 2AWF, 2AYV, 2BRC, 2AC, 2BJ, 2FB, 2FC, 2JW, 2PL, 2PU, 2TA, 2YN, 2ZK, 2ABB, 2AGT, 2AJD, 2AQL, 2AWE, 2BFU, 2BYG, 4FD, 5BQ, 5CF, 5CH, 5EW, 5FT, 5KY, 5LB, 5MZ, 5RQ, 5SP, 5TT, 5UH, 5VQ, 5WD, 5WU, 5XE, 5ABB, 5ABG, 5ACF, 5AFB, 5AFG, 5AHQ, 5AHZ, 5AJV, 5AJW, 5AMZ, 5AOZ, 5APE, 5ARD, 5AUX, 5AUY, 5AVJ, 5AVT, 5AWU, 5AXO, 5AXY, 5AZF, 5BAC, 5BAZ, 5BFI, 5BHV, 5BRI, 5BSY, 5BZU, 5CGZ, 5CPF, 5HR, 5MC, 5TV,

5UH, 5UL, 5YB, 5YM, 5AMT, 5ARX, 5AUL, 5AZA, 5AZE, 5DCX, 5DSO.

C.W.: 1II, 1JG, 1LZ, 1PR, 1RD, 1SN, 1TB, 1XM, 1XZ, 1YZ, 1ZE, 1ADG, 1ADL, 1AGI, 1AKG, 1ABY, 1ASF, 1AZW, 1BAS, 1BBU, 1BDI, 1BEP, 1BGE, 1BGF, 1BKA, 1BKQ, 1BLE, 1BSD, 1BTL, 1BWJ, 1CAK, 1CJH, 1CNI, 1CNR, 2CK, 2DN, 2EH, 2FF, 2HW, 2RD, 2RU, 2TP, 2XI, 2XJ, 2XK, 2ZK, 2AGB, 2AVU, 2AWF, 2AYV, 2BEA, 2BEH, 2BGM, 2BJS, 2BML, 2BNZ, 2BRC, 2BRD, 2CBG, 2CJN, 2CC, 2IW, 2NO, 2XW, 2ZO, 2ZY, 2AJD, 2ANJ, 2APQ, 2BHL, 2BQ, 2BY, 2GL, 2GX, 2FV, 2DV, 2NB, 2OW, 2OZ, 2PT, 2QZ, 2SP, 2TB, 2UK, 2VY, 2VY, 2XB, 2XD, 2XE, 2XV, 2ZK, 2ZZ, 2AAN, 2ADG, 2ACF, 2AFE, 2AIO, 2ALB, 2AQF, 2AQO, 2AWP, 2AWY, 2AXC, 2AYR, 2AYZ, 2BAC, 2BGL, 2BDU, 2BEO, 2BIZ, 2BKE, 2BLX, 2BMA, 2BMU, 2BNI, 2BSS, 2BUN, 2BUQ, 2BWT, 2CIS, 2CKO, 2CLW, 2CNU, 2XAE, 2ZAE, 2BP, 2ARK, 2BNO.

#### 5NB, Rochester, N. Y.

C.W.: 1II, 1ON, 1PT, 1QP, 1RD, 1UN, (1VQ), 1XM, 1YB, 1ADL, 1AP, 1ARY, 1ASF, 1AVR, (1AZW), (1BBW), (1BDC), (1BDI), (1BES), 1BGF, 1BKA fone, (1BKQ), 1BNT, (1BEQ), 1BSD, 1BYN, 1CAK, (1CHJ), 1CJA, 1CJH, 1CNF, 2DE, 2FC, 2FP, 2KL, 2KP, 2NF, 2RM, (2SQ), 2XI fone, 2AAB, 2AEH, 2AGB, 2AID, 2AIF, (2AJA), (2ANM), (2AQH), 2AQU, 2AWF, 2AWS, (2AXK), 2AYV, (2AZZ), (2BBB), 2BEA, (2BEH), 2BGB, 2BGL, 2BLF, 2BML, 2BNZ, (2BQU), 2BTJ, (2BTW), 2BUM, 2BXP, 2CBW, 2CCU, 2CFL, 2CFT, 2CJN, 2BA, 2BZ, 2CA, (2CC), (2DM), 2HG, 2IL, (2IW), (2NH), 2NO, (2QV), 2QZ, (2VW), (2ZO), 2AAY, (2ADX), 2AJD, 2AKI, 2ALL, (2ALN), (2ANJ), 2ANY, 2AQH, (2ARO), 2ASW, (2BEC), 2BHL, 2BIJ, 2BLF, 2BNU, 2BRW, 2BTK, 2BUV, 2BQ, 4BF, (4CO), 4DC, 4DF, 4DQ, 4DS, 4EU, 4GL, 4GN, 4GX, 4ID, 4IL, 4ZC, 4ADL, 5FV, 5AAM, 5BO, 5XAD, 5BES, 5WV, 5XAF, 7XF, 8BQ, 8BU, (8EA), (8ED), 8EV, (8HJ), 8HT, (8KH), 8LB, (8LT), 8LW, 8NV, (8PN), 8PT, (8QB), 8QZ, 8RQ, 8SE, 8SP, 8UC, (8UE), (8UK), 8VJ, 8VY, 8VR, 8WB, 8XE, 8ABM, 8ACM, 8ADG, (8AFE), (8AGK), 8AGO, (8AIO), 8AJV, (8ALB), 8ALT, 8ANB, 8ANJ, 8AOO, 8AQF, (8AQO), 8ARE, 8ASV, (8AUY), 8AVD, 8AVL, (8AWM), (8AWP), 8AWW, 8AWX, 8BDU, (8BEB), (8BEN), (8BEO), 8BGV, 8BIT, 8BQM, 8BQU, 8BRL, 8BSO, (8BSS), 8BSY, (8BUX), 8CAY, (8CAZ), (8CBJ), (8CCU), 8CCX, 8CFR, 8CID, 8CKO, (8CLW), 8CON, 8CPG, (8CPX), 8CQL, 8ZAE, 8BF, 9EI, 9FZ, 9IL, 9IO, 9KP, 9PL, (9UH), 9WQ, 9AJA, 9AOG, 9AOU, 9ARK, 9AXF, 9BED, 9BFG, 9BGH, 9BJB, (9BLC), (9BTA), 9DAX, 9DIO, 9DKY, 9DYN, (9DZQ), 9YAJ, Can. (3JI), 8JK, 8SJ, 9AL WHQ.

Spark: (1BOQ), 1COK, 2FP, (2AAF), 2AER, 3PU, 3AAC, 3ABB, 3ARN, 4BI, 4CX, 4CH, 4KY, 4AFG, (4AHQ), 4AIT, (4AMZ), 4AUY, 4AVT, 4AWU, (4AXQ), 4AYC, 4BAZ, 4BLZ, 4BKO, (4BXT), (4CAH), (4CMC), 4CKT, (4ZO), 5OX, 9UU, 9ACB, 9ALE, 9AMT, 9ARG, 9DMJ, 9DSO.

#### SBIL, Warren, Pa.

C.W.: (1ADL), 1AIP, 1AKG, 1AQW, 1BDC, 1BDI, 1BES, 1BGF, 1BLE, 1BNT, 1BSB, 1BTL, 1BWJ, (1CAK), 1CGS, 1CIK, 1CJA, 1CJH, 1CJZ, 1CK, 1CNF, 1EE, 1HX, 1II, (1PR), 1PT, 1XM, 1YE, (2AAB), 2ABZ, 2AEH, 2AGB, (2AME), 2AMJ, 2AWF, 2AWJ, 2AWS, (2AYV), 2BEA, 2BFT, 2BGI, 2BJR, 2BLP, 2BML, 2BNZ, 2BHQ, 2BQU, 2BTJ, 2BUM, 2BXP, 2CFL, 2CFT, 2CJN, 2DK, 2DX, 2FP, (2FZ), 2KP, 2LH, 2OF, 2RU, 2RY, 2SQ, 2TP, 2VC, (2AAO), 2AAY, 2AJD, 2ALL, 2ALN, 2ANQ, 2ANY, 2APQ, 2AQH, 2ATZ, 2BEC, 2BHL, (2BIJ), 2BZ, 2CA, 2CC, 2DM, 2FF, (2FR), 2FS, 2HG, 2IL, 2IW, 2NH, 2NO, (2VS), 2ZO, 4BQ, 4BY, 4DC, 4DS, 4EN, 3EU, 4GL, 4GX, 4ID, 4IL, 4JL, 4LP, 5DA, 5AGO, 5AIO, 5AM, 5ANB, 5AOC, 5AQF, 5AQO, 5AVD, (5AVL), 5AWM, 5AWP, (5BCL), 5BDB, 5BDO, 5BDU, 5BEF, 5BES, 5BFX, 5BJV, 5BNI, 5BO, 5BPI, 5BPL, 5BVA, 5BXH, 5CAZ, 5CGL, 5CID, 5CKM, 5CKO, 5CMM, 5DU, 5GV, 5HJ, 5HM, 5LX, 5NB, 5OW, 5OZ, 5PT, 5SE, 5SP, 5UE, 5UK, 5VQ, 5VY, 5WR, 5XAE, 5XK, 5XY, (5YM), 5ZAE, 5AAY, 5AOU, 5APE, 5ARK, 5ATY, 5BED, 5BFG, 5BLC, 5BF, 5BSG, 5DAX, 5DDE, 5DZQ, 5GL, 5HM, 5II, 5IO, 5KP, 5LQ, 5ME, 5SL, 5WA.

**9BGD, Kendallville, Indiana**

Spark: 5HK, 5HR, 5SM, 5XB, 5UE, 5EW, 8UC,  
3EA, 8YN, 9FX, 9KI, (9FK), 9IY, 9LF, 9NQ, 9LW,  
9RY, 9XT, (9AAW), 9AEY, 9AFW, 9AFD, 9ALM,  
9AQE, 9ATN, 9AVZ, 9AZA, (9BCF), (9BSZ),

**9DQB & 9DRV, Mt. Carmel, Ill.**

C.W.: 1IN, 1BME, 2AJA, 2BEA, 2NZ, 2XAI, 2XJ, 3AQR, 3AOV, 3BF, 3BHL, 3BLJ, 3HZ, 3MO, 3QZ, 4AS, 4BY, 4EH, 4FF, 4FT, 4GL, 4HP, 4IV, 4LP, 4ZC, 5ABM, 5AL, 5DO, 5DJ, 5EK, 5EU, 5HB, 5JB, 5OI, 5LA, 5TT, 5XAK, 5XU, 5YG, 5ZA, 5ZAP, 5ZL, 5ZX, 8ANO, 8ARZ, 8AWZ, 8ARU, 8AWX, 8BDU, 8BFX, 8BI, 8BKE, 8BLW, 8BNO, 8CAZ, 8BPO, 8EA, 8OZ, 8QZ, 8XE, 8YA, 8ZZ, 9AK, 9AAS, 9AAV, 9AAW, 9AAZ, 9ABU, 9AJA, 9AJH, 9AKD, 9AOU, 9AMI, 9AOV, 9ARK, 9ASL, 9ASY, 9ATA, 9AWA, 9BP, 9BZ, 9BAF, 9BAP, 9BBF, 9BIK, 9BLO, 9BND, 9BRL, 9DCR, 9DGL, 9DGG, 9DKY, 9DQK, 9DZQ, 9IO, 9EL, 9JR, 9KP, 9LA, 9PS, 9QF, 9VK, 9WA, 9XM, 9YC, 9YK, 9YAK lone, 2XJ, 2XAI, 9MC, 9XM, 9ZAF.

Spark: 8ABB, 8AOV, 4BQ, 4BI, 5DO, 5FO, 5GI, 5HK, 5KC, 5SM, 5XA, 5YE, 5ZL, 5ZAA, 5ZAB, 5ZAR, 8EA, 8YA, 8AG, 9ACB, 9AIY, 9AFX, 9ARR, 9ASJ, 9AXU, 9DDZ, 9AZA, 9DLR, 9DQK, 9DZI, 9DKK, 9GU, 9IF, 9LF, 9MC, 9PE, 9UU, 9ZJ, 9ZL.

**9AOG, Lawrence, Kansas.**

C.W.: 1BGF, (2BEH), 2BML, 2FP, 2RM, 3BA, 3BUV, 3IW, 3QV, 3QZ, (4BF), 4BQ, 4BY, 4CB, 4CO, 4EB, 4GC, 4GL, 4KU, 4ZC, (5AAC), (5AAM), 5BM, (5CB), 5DO, (5EK), 5FO, 5FV, (5HB), 5HL, (5JB), 5LA, 5LJ, 5MT, 5MX, (5OI), 5PB, 5RL, (5XU), (5YG), (5ZA), (5ZAT), 6BES, 6JD, 6KA, 6XAD, 6ZAC, (7ZU), 8AGO, 8AIM, 8AIO, 8AIX, 8AJV, 8ALB, (8AMM), 8ANB, 8AQF, (8AQO), 8AQZ, 8ARK, (8AUU), (8AWM), 8AWP, 8BDB, 8BFX, 8BKE, 8BLW, 8BRL, 8BSS, 8BU, 8BZY, 8CFP, 8CKM, 8CLW, 8CMM, 8CQL, (8EA), (8HJ), 8HM, 8OZ, 8PT, 8QB, 8RQ, 8SP, (8UC), 8VQ, 8VY, 8XE, 9AAP, 9AC, (9AEG), (9AEQ), (9AIY), (9AJA), (9AJH), 9AJS, (9AKD), (9AMB), 9AMO, (9AOR), (9AOU), (9APE), (9APW), (9AQR), (9ARG), 9ATE, 9ATU, 9AUA, (9AXF), 9AYU, 9BAF, 9BBA, (9BBE), 9BBF, 9BDB, 9BDP, 9BDZ, 9BED, (9BFG), 9BGH, (9BHD), 9BJB, (9BLC), (9BOA), 9BOW, 9BP, 9BRC, 9BSG, (9BTA), 9BUN, (9BWK), 9BYB, (9CCS), (9CT), 9DAX, 9DDH, (9DIO), (9DJB), (9DKW), (9DKY), (9DOF), (9DPE), 9DPG, 9DPL, (9DR), (9DRW), (9DSK), 9DSM, (9DTA), 9DTS, 9DUG, (9DUN), 9DWY, 9DXE, (9DZQ), 9EI, 9EW, (9FZ), (9IF), 9IL, 9IO, 9IZ, 9JG, 9KP, 9LQ, (9NU), 9OF, (9OO), (9PI), 9PS, (9QE), (9QF), (9SJ), 9SL, 9SO, 9VK, 9WA, (9WD), 9WK, (9WQ), 9WU, 9XAQ, (9XI), (9YAJ), 9ZL, AA7, Canadian 4BV.

Spark: 3JL, 5ABY, 5BE, 5CA, 5FI, (5FO), 5HK, 5HL, 5IF, 5IQ, 5JD, (5JF), 5MF, 5MR, 5NC, 5NS, (5PE), 5QS, 5SM, (5TC), 5TG, 5TU, (5UE), (5YG), 6EX, 7ZV, 8AHQ, 8AIT, 8ATJ, 8AXN, 8BBU, (8BXC), 8EB, (8JJ), 8UC, 8YN, (8ZO), 9AAW, 9ABV, 9ACN, 9AEY, 9AFK, 9AGR, 9AHZ, 9AIG, 9AIU, 9AJB, (9ANO), 9AOJ, 9APK, (9AQE), (9AQZ), (9ARG), 9ARP, (9ARZ), 9ATN, 9AUL, (9AVH), 9AVK, (9AVX), (9AVZ), 9AWX, 9AXU, 9AYW, 9AZA, 9AZF, 9BIW, (9BKK), 9BLB, (9BLW), 9BNT, (9CAK), 9DAN, 9DAZ, (9DDZ), 9DFA, (9DGV), (9DJB), 9BDD, (9BLC), 9DLU, 9DLY, (9DMJ), (9DPE), 9DPG, 9DRW, (9DOT), (9DSD), 9DSO, 9DUG, (9DVF), 9DWT, 9DZI, 9DZY, 9EV, 9FF, (9FK), 9GP, 9HI, (9KA), 9LF, 9LW, 9MC, 9OX, (9RR), (9RY), 9SN, 9SY, 9TH, 9TV, 9VL, 9VZ, 9WI, 9WT, 9WX, 9XI, 9WT, 9WX, 9XI, (9XT), (9YAJ), 9YM, 9YO, (9YU), 9ZH, AA7.

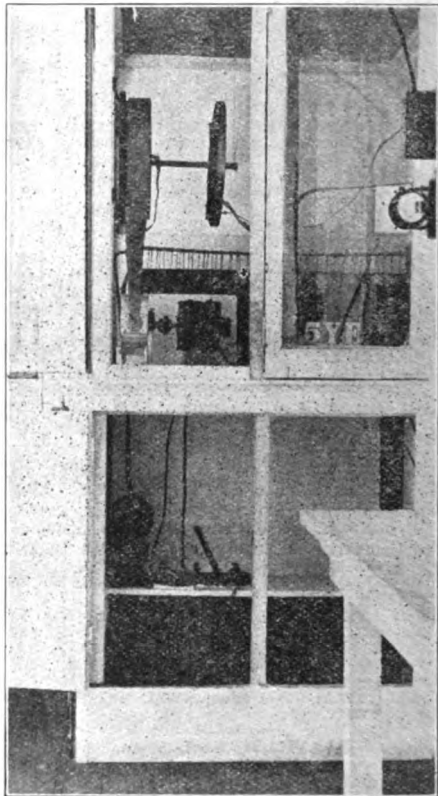
**5YE, UNIVERSITY P. O. MISS.**

(Concluded from page 59)

equipped with a Magnavox, DeForest wave-meter and all switches for charging the batteries without moving.

In the "Calls Heard" column of QST 5YE has been reported d from Battle Creek, Montana, Hartford, Conn., Roswell, N. M., and has been reported QSA in thirty-three states. Sustained communication has been kept up with Ellendale, N. D., and with Tela, Honduras. The station is maintained

by the Physics Department of the University of Mississippi under the direction of Prof. W. L. Kennon, A.R.R.L. District Supt.



for Mississippi, and operated by a corps of students always ready to handle relay traffic.

**Wouldn't It Be Wonderful—**

If we had been born rich instead of with brains?

If the predictions come true about movies by wireless?

If someone admitted that A. L. Groves was right for once?

If somebody would invent a wire hair-net to be worn with a pair of Murdock phones?

If people would see the A and L in A.R.R.L. emblems and stop asking you what railroad you worked for?

If visitors on listening to KDKA would quit asking you to tune out static so the music would be heard plainly?

If Round's round ground could be installed in 30 minutes?

If nobody sent "CQ", including 3ACS?

If you didn't occasionally hear your own call being signed off by some other bird?

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Check!

Chicago, Ills.

Dear Editor:

More and more are we being reminded of the presence of the novice, with his broadcasting receiver. They are taking our air, and taking our magazines.

I have just finished reading the May "\_\_\_\_", and notice that while the magazine is larger it is entirely turned over to the novices and their broadcasting. Not one line is left for the old A.R.R.L. gang who originally put the magazine on its feet. Probably they will make more money from the novices, so I suppose it is their privilege to throw us out. But gosh, old boy, don't let 'em have our QST. I notice our new "With the Radiofone" department. While it is not very big it, is a step toward giving the novices our QST. We'll divide the air with them, and divide our magazines—but not QST! That's sacred ground, and "they shall not pass!"

Sincerely,  
R. W. Wahlstrom, 9RC.

## Bum Fist?

2012 Metts Avenue,  
Wilmington, N. C.

Editor, QST:

Howcum station 4EW is being reported all over the eastern part of the country when said station is not even in operation? In the last few weeks I have received cards from about fifty stations reporting my C.W. sigs QSA in about fifteen states. Having been advised by Inspector R. Y. Cadmus that call 4EW has not been reissued by mistake, I cannot but think that some bird is using my call either through ignorance or intentionally.

Several of the cards received were from amateurs who had worked this station, and one letter stated that the name given him by radio was Edwin Y. Webb. Upon reference to the call book he of course found my name and address, and accordingly sent the letter to me.

I shall be duly thankful to Mr. Edwin Y. Webb if he will communicate with me and get the matter straightened out, or to anyone who can give me his address so that I may communicate with him.

Very truly yours,  
Albert Davis, 4EW.

## Tell 'Em

Jamestown, N. Y.

Dear Ed—

Now that there are about 600000 "novices" who care nothing or comparatively little about the work of the A.R.R.L. and its members at large, I suggest that each and every member of our organization, whether he has a call or not, get out his paint brush and make a sign that can be read from some little distance. Have the would-be sign painter paint in bold and vivid style the letters, "A.R.R.L." and if he has a call have him plaster that on the nameplate so that all the world can read it without glasses. Then after the paint has set, let him hunt up the family hammer, procure some nails and march to the tree that shades his front lawn and absorb nine tenths of his antenna current and "hang up his shingle".

With this done, it is an easy matter for a brother from a neighboring city to locate a real Radio Man instead of one of some three or four months experience, who persists in calling these poor excuses we now have for tubes "globes", etc.

Yours truly,  
Ex-8AAI (2nd).

## Home-Made Knobs

Box 287, Gastonia, N. C.

Editor, QST—

Here is a "kink" that may be useful to some fellow amateur who needs some knobs right away and is either "broke" or has no wireless supply store near by. This was my plight and I solved it in the following manner.

My father is a dentist, and consequently has a good many pieces of Kerr's Impression Compound lying around the laboratory. This compound is a maroon-colored substance that is easily softened by hot water, and when in this condition it can be easily molded with the fingers or prest into a mold to make any style or size knob. While it is hot a set screw can be forced in from one side and when the knob is cold the threads will be found inside of the hole as if cut with a tap. It would be well to be sure that the compound is prest tightly about the screw while hot as the threads will hold the strain better and be stronger.

When cold the compound is of reddish

color, hard, and a very good insulator. Used pieces of this compound may be obtained from any dentist who makes false teeth. It may be used over and over again by softening and re-molding.

So long, O.M.,  
Dan McConnell.

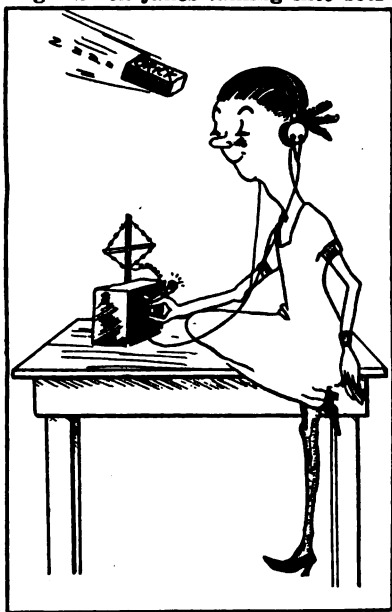
P.S. Any inquiries will be gladly answered. Some of you bugs in other parts of the country write me.

### These Radio Photographs

Podunch, N. J.,  
April 1st, 1922.

Dear Editor:

This radio game is getting punk lately. Why, pick up any newspaper and take a look at some of the radio pictures they are printing. Swell janes talking into sets that



have no tubes in the sockets, well known men listening in on receivers that have nothing connected to them, faithful Fido listening to his master's voice coming from a six foot loud talker connected to a \$16 crystal set, and wotinellnot. The one that got my nanny was one showing a sweet young thing listening in, the cans clamped on her toostie ears, and her face registering love, longing, sighs, etc. The caption to the foto was—"Receiving her morning kiss by the wireless"—note the "the wireless." Accordingly, I took my trusty pen in hand and penned this missive, also the cartoon attached. Print it, and let the public know something of the farces that are being put over on them.

Your brass pounder,  
Amplifier Ambrose.

—(Reproduced from "The Modulator," of New York City, the Second District's amateur magazine.)

### De Pearson fm Ardrossan

The following is a letter to Paul Godley from Mr. Pearson who, it will be remembered, was checking operator with "Paragon Paul" at Ardrossan and whose picture appears along with the account of the A.R. R.L. Transatlantic Tests described in our February issue.

S. S. Saturnia,  
At Portland, Maine.

Dear Friend:

I have been extremely busy as most of my spare time has been devoted to association work, and when I get home at night I have not had the heart to write. How are you, auld friend? Now that I am on your native soil I am filled with longing to see you and have a chat. It seems ages ago since our Ardrossan affair. Was delighted to know of the warm and enthusiastic welcome you received. It was due you as you certainly stuck it well.

I was seriously thinking of coming down to the "village" from here, but when I calculated how many bottles of Scotch food I could buy with the cash I would spend on train fares, I be-grudged the fare. There is not much danger of getting a New York boat from Glasgow, as all of the passenger boats from there are operated by the Radio Corp. The ship goes to Montreal until the end of the season, about November, and I fancy this will be my home from home until then. Though not much of a liner she is up-to-date with good gear, having a C.W. transmitter type A1, direction finder 11A, valve receivers, etc., etc. Our principle cargo is whisky and as you know "where the body is there shall be the vultures". My predecessor got fired owing to lack of capacity.

Did you get your cash from the custom's at Southampton all right? Your full report in the QST was extremely interesting to me. It recalled dirty nights but on the whole I enjoyed it and would not mind turning to again. Next year I presume some one will be visiting the old country with a "phone". I hope I am on the job. There have been dozens of visitors abroad wanting to see the set and yours truly. Somehow it has been circulated that I am aboard "Saturnia" and long explanations (dry work) has been my unhappy lot. The enthusiasm is keener than mustard round this district; even the ladies are seriously interested. Three of them yesterday stayed over an hour listening to a concert.

If you are writing to Mr. Warner, be good enough to thank him for the copy of QST which he forwarded to me. I shall be pleased to assist in any way this summer. It might be interesting to know how many stations can be heard. When we are off Labrador coast coming through Straits of Belle Isle I will tune in for amateurs (if work permits it) every fourth hour for



20 minutes commencing midnight 75th meridian time (three days after boat sails from Montreal we will be in Belle Isle Straits). Perhaps your friend Mr. Armstrong will send "MGES". Gee. it makes me smile even yet.

We are sailing today for Halifax, then dear old dirty Glasgow, due about 24th inst. Sincerely trust this finds you in the best of health. Will be delighted to hear from you at your earliest convenience. Kindest regards.

Yours sincerely,  
D. E. Pearson,  
30 Stirrat Place,  
Barrhead, Renfrewshire, Scotland.

### Defending Cages

Schenectady, N. Y.

Editor, QST:

Seeing Mr. Braden's letter in the April QST concerning cages and flat-tops I should like to say a few words in favor of the cage.

I have had several transmitters including 1 K.W. spark and 100 watt C.W. sets. I have been using a flat-top 50 feet high and 75 ft. long of 3 wires 8 feet apart, for several years. The antenna current on spark was 4 thermocouple amperes with the flat-top and a buried ground system.

Using 2 U.V.203 Radiotrons supplied with 1250 volts at 375 mills on the plates and 10 volts on the filaments the maximum antenna current was 3.2 thermocouple amperes with ground and 4.0 with 1800 foot radial counterpoise. The greatest DX on the C.W. was Washington, D. C.

About 5 weeks ago I put up a cage antenna 50 feet high and 60 feet long, 2 feet in diameter and consisting of 6 stranded wires. Temporarily I used a single wire lead-in and the antenna current was 4.6 T.C. amps. On the first night I had the cage, almost any station that I called came back with report of "QSA vy."

Next day I put a 4 wire cage lead-in on and the antenna current went up to 5.3 amps., where it has remained. Inside of a week I received 32 cards from as far west as Chicago, from 1VT and 3BAG. A card from 2CAH said that I came in like local stuff right thru QRM from New York City. I had never been able to do such DX work and I expect that with further improvements in the set itself that I can get out better still.

I give all the credit of doubling my range to the cage antenna. The cage lead-in, it seems to me, gets the juice into the antenna and the cage seems to be a better horizontal radiator of energy than a flat-top.

Hoping this will interest some of the gang, I am,

Respectfully yours,  
Charles E. Gardiner,  
Radio 8TB.

### "Violet Rays"

Hico, Texas.

Editor, QST--

In looking through March QST I came across a letter by one Eoline R. Hand, which dealt with the violet ray machine as a radio transmitter (see page 62). I do not know that there has ever been any previous mention of this but I can hardly conceive of any one having to go to the trouble he took to find out whether it would affect radio receivers. I am using a short wave regenerative receiver without amplifiers, and I can say without exaggeration that whenever a violet ray machine in one hundred yards of my set starts to "reach out" I might as well quit trying to receive for not even a 1 K.W. set 20 miles from here can be read. It does not make any difference whether the applicator is brought near a conductor or not, the effect is the same.

When the first of these nuisances made its appearance in our town I was at a loss to find a way to account for the rather mysterious "signals". The machine was some distance from here, and did not, therefore, come in very loud. It sounded like some "ham" with a plain aerial hook-up sitting on his key. We, a friend "bug" and myself, thought it was some one installing a spark coil set with a plain aerial, but we listened in vain for his first sign. Later two or three others made their appearance, none of them very close to either of us. It was not till the OM at our house purchased one that we found the solution to the mystery. And I for one would have preferred to remain in ignorance. I think there are a dozen or more here now, some of them pretty close.

For the benefit of those contemplating experimenting with these machines I will say that the violet ray machine is just a spark coil of small size connected to an oscillating circuit in which is the primary of the high frequency transformer of a few turns. The secondary has a great many turns and hence the output is high frequency high voltage current. It is a well known fact that a high frequency electrical discharge when passed through a rarified gas will cause that gas to glow, the color depending on the kind of gas used. The term "Violet Ray" is derived from the fact that the output passes through a tube of gas which gives this distinctive color when operating. Naturally the good to be derived from this machine comes not from the violet rays as such but from the fact that there is a high frequency current present. In fact, it is probable that the same results would be accomplished if the violet rays were entirely eliminated. But I am digressing from the subject. It will be readily seen from the above description that the machine is simply a miniature radio transmitter the whole of which is contained

in the case and the output of which instead of being connected to an antenna and ground is connected through the violet ray tube, the patient's body, (and the operator's body in some cases) returning by leakage through the air or by the condenser effect of the patient's body and the terminal of the secondary not otherwise connected. It is not at all surprising then to find that it can be used as a transmitter. Nor should one be surprised to learn that its wave is very broad and probably of a multiple character, as well as very high decrement. I think the wave of the ones here extend up to about 1000 or 1500 meters and down as far as the tuner can tune. Their decrement seems to be about "1000". So I would not advise anyone to use these machines for radio transmitters unless the "oscillation transformer" is removed and a real one properly coupled and adjusted is substituted in its place. In its original form it is certainly a QRM factory de luxe. It may be that it can be so adjusted that it can be used to advantage for short distances and possibly for directional sending though I do not think it likely that it can be used for more than a few miles at the best.

I am writing this with the hope that it will be published so as to give the radio fraternity a little more knowledge on a line that bids fair to become a great nuisance as the machines in use increase in number. Not that I claim to know it all for I confess that I do not by any means, but my letter may be the means of getting some one who does know to give us his information. I would very much like to know how to stop the QRM it causes, if perchance some kind fellow-bug will enlighten me. I have tried everything I know of but the only plan discovered so far is to cut off the "A" & "B" batteries, lay the phones on the table and QRT until it is finished.

Wel, OM, CUL Best 73's de "SOL".  
Theron Eakins.

### Expert Testimony

Noroton Heights, Conn.

Editor, QST—

I presume you have read in the papers of the wave of crime that has swept New York. It has extended even to the "radio departments" of several of the papers. The other evening the "radio expert" of the Evening Mail told in beautiful language of the functioning of the detector. He said that it was just like a one-way door. It allowed the radio frequency current to pass in one way only, and the result was that one half of the oscillations were cut off, and the reduction of the radio frequency wave by 50% thus converted it into audio frequency, so it could be heard. In the same issue, another author (?) claimed that the

antenna was the "door" of the receiving set. Pity the poor tyro. I guess he'll be ready to think that the peep holes in front of the tubes are the "windows" through which the carrier waves come into the little receiving house.

And the enclosed is, to me, mighty interesting. According to the writer, messages leave our transmitters from the end of the aerial, and "enter" on the end of the ground, which is the same as the trailer of the 'plane. Please tell me where the end of my ground is. I'd like to locate it as, if I could bring it closer to my set, it would undoubtedly make the path of the incoming messages shorter, and, by the same line of reasoning the messages would be louder, and there would be no need of amplifiers. Great stuff to feed the newcomers on.

With best regards,  
P. E. Fansler, 1XAA.

### Radio Phones—and Honesty

By L. Q.

NOT so very long ago an acquaintance of mine drove up to the shop with an old car.

"Well George, what do you think of my \$400 car?"

"She'll do for a couple of seasons if we can get rid of that crankshaft knock and patch the radiator and put in a new rear end."

"Well, here's an honest man and a friend. You're the first one that has *knocked*" this old wagon."

*Moral*—When a radiofone asks you "Hrrow ishrr mrryr modrrrulationrr" be an "honest man and a friend" to him and to Radio and say—

"You have a savage commutator roar and need a filter, also the set over-modulates and rattles badly. Want me to come and help fix it?"

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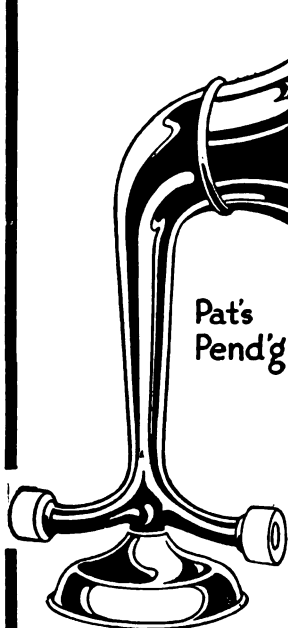
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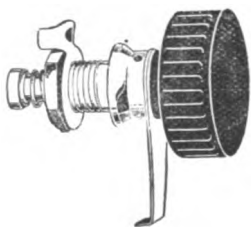
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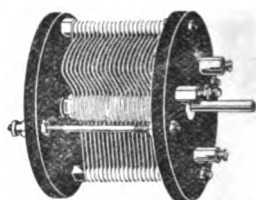
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| R-60 43         | .001 Mfd. 4.75     |

# Industrial Controller Co.

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## A REAL BOOK ON RADIO

Just off the press. A concise non-technical treatise on Radio for the Layman. Plain language, diagrams and everything. Something that you can understand.

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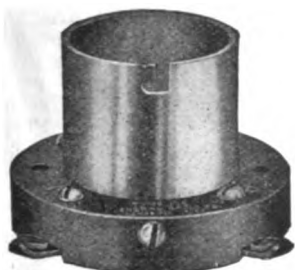
Treated by a new scientific process which imparts extraordinary powers of rectification. Keeps its sensitiveness. Radiophones tested before and after mounting. Mounted ..... 50c  
Unmounted ..... 35c.

THE STANDARD CRYSTAL CO.  
274 Halsey St., Newark, N. J.





# To A.R.R.L. Operators A Chat Among Ourselves



**TYPE 156**  
**Vacuum Tube Socket**  
**Price \$1.50**



**TYPE 214A**  
**Filament Rheostat**  
**Price \$2.50**



**TYPE 231A**  
**Amplifying Transformer**  
**Price \$5.00**

Prior to 1917, the radio experimenter was looked upon as a sort of pest. When the war broke out and the radio operators were needed, he was one of the first to be called to the colors. After the war came the fight to regain the pre-war transmitting privilege. This victory won and conditions stabilized, so that serious thought could be devoted to relay routes and Trans-Atlantics; then came the broadcasting. With it the inflation of radio.

The radio pest again became a hero. He was called upon daily to build sets or recommend instruments for the newcomers. What is he doing? He is using and recommending the same make of instruments that gave him reliable service prior to 1917, during his wartime service, and since the re-opening of his station.

The General Radio Company supplied you with instruments of quality before the war, during the war, and ever since. The enormous demand that you have made on us by recommending our instruments to the newcomers has, naturally, taxed our plant to the extreme. We are doing our best to meet the demand. We are not cheapening our instruments. You have relied on them in the past and you may continue to do so in the future. Every instrument that we have ever manufactured has been guaranteed. Continue to buy instruments where quality counts.

*Send for Free Radio Bulletin 911-Q*

## **GENERAL RADIO CO.**

**MASSACHUSETTS AVENUE AND WINDSOR STREET**

**Cambridge 39, Massachusetts**

*Standardize on General Radio Equipment Throughout*

# MONARCH RADIO EQUIPMENT



## Latest Type Radio Head Sets

—have been designed and are now under production by the Monarch Telephone Mfg. Co. These new Head Sets reproduce vocal and musical sounds with remarkable distinctness. They are high grade throughout; not a cheap product in any way. We have built high grade telephone equipment for over 20 years, and are well qualified to manufacture high quality Radio equipment. Plugs, keys, jacks, cords and binding posts can also be furnished.

If your jobber or dealer does not have Monarch Head Sets in stock, let us hear from you.

Code No. 2-A 2000 ohms..\$8.00

Code No. 1-B 2500 ohms..10.00

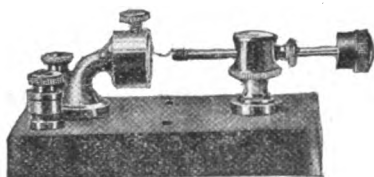
Code No. 1-C 3000 ohms..12.00

Backed by Over 20 years of Telephone Manufacturing Experience

**Monarch Telephone Mfg. Co.**

FORT DODGE, IOWA

## EMSCO RADIO PRODUCTS - MADE BY EXPERIENCED ELECTRICAL MANUFACTURERS



### TURRET-TOP DETECTOR

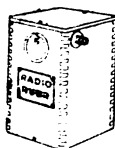
Decidedly the best detector so far produced. Sturdy and well made of the best materials. "Turret-Top" swivel adjustment permits the greatest range of adjustment and holds the phosphor-bronze "cat whisker contactor" steadily in any position. Thumbblock assures permanent adjustment. Locking-notch feature of binding posts exclusive with this detector. Unbreakable base. A fair example of EMSCO quality and value.

You take no chances when you buy EMSCO products. Behind each article is the skill of many years experience making wireless and electrical equipment. That is why the trademark, EMSCO, always signifies outstanding merit. Reliable dealers handle EMSCO products. If your dealer hasn't them write us.

### JUST A FEW EMSCO PRODUCTS

| Single and Double   | Square Rods Cut and Drilled | Weatherproof Strain Insulators |
|---------------------|-----------------------------|--------------------------------|
|                     | 1/4"x7                      | 1/4"x8                         |
| Wound Rotors        | x8                          | x10                            |
| 3"—8 1/2"           | x10                         | x12                            |
|                     | x12                         | Vario Couplers                 |
| Single Slide Tuners | 1/4"x7 Extension Threaded   |                                |
| 6"—8"               |                             |                                |
| Binding Posts       | Enamel Wound Coils          | Sliders                        |
| Double Slide Tuners | 6x8" 8x8" 8x8 1/2"          | 1/4" and 1/2"                  |
| 6"—8"               |                             |                                |

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### WIRELESS "A" BATTERIES

Built Especially for Radio Requirements.

Gives Clear Uniform Delivery

6 Volt 50 Ampere \$15.00

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Our price list, mailed Free on request. Contains complete lists of reliable Radio Sets and parts—every article carrying our guarantee. Mail orders given prompt attention.

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# Federal RADIO APPARATUS

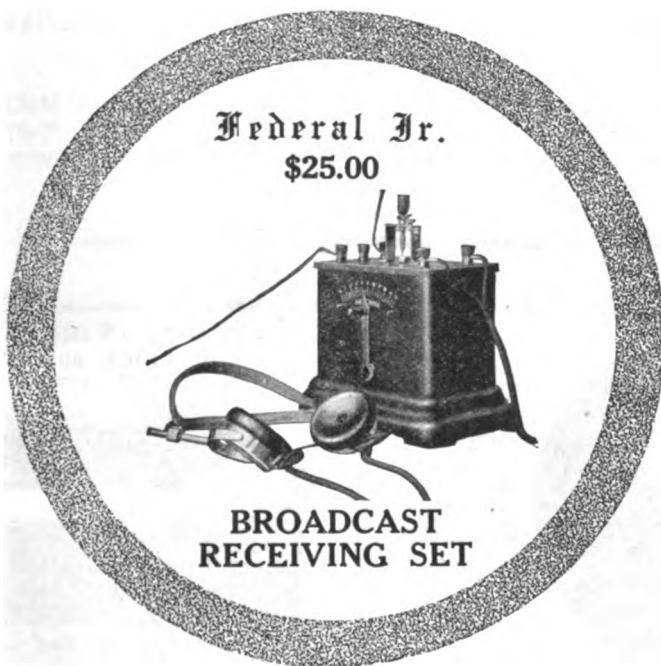


## HAND MICROPHONE SET

The most efficient and conveniently arranged Microphone for Radio Telephony is the No. 260-W Hand Set illustrated above. All exposed metal parts are nickel plated and highly polished, and a metal hook is provided for hanging up. The handle is made of corrugated hard rubber and of a size easy to hold. On account of the novel shape and position of the mouthpiece the Microphone is always in proper position for best results.

Fitted with 6ft Cord, Price in U.S.A.....\$7.00 each

The FEDERAL JR. is, in itself, a complete receiving set requiring nothing more than the aerial wires for its operation. It is most ruggedly and simply constructed, beautiful in appearance, simple in its operation and absolutely reliable. No batteries or other source of power are required for its operation nor are replacements of any kind ever required.



The FEDERAL JR. radio telephone receiver is built of highest grade material throughout; it has been designed with the highest type of engineering skill with the aim of making it of highest possible efficiency compatible with ruggedness of construction and simplicity of operation. It is built with the same careful attention to detail that has given FEDERAL apparatus its high place in the electrical world for the last 20 years.

## AUDIO FREQUENCY TRANSFORMERS

The amplifying qualities of the FEDERAL No. 226-W Transformer can be attested to by thousands of satisfied users. The impedance at 500 cycles is the same as the internal impedance of the standard tubes available today. The flux leakage is kept at a minimum, reducing the tendency to oscillate, due to stray fields between circuits in cascade amplification. Price in U.S.A.....\$7.00



**Federal Telephone & Telegraph Company**  
BUFFALO, N. Y.

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# RADIO PANELS

and

other insulation for Wireless Work

## BAKELITE-DILECTO

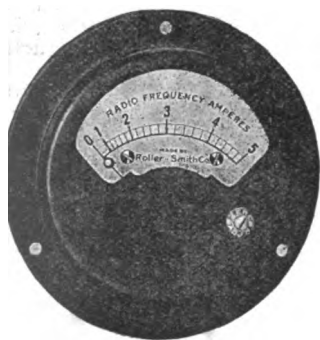
Grade XX Black was used by the Government during the war for this purpose. It is the:

**STANDARD OF THE WORLD**

**THE CONTINENTAL FIBRE COMPANY**  
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**How Many  
Amperes  
Are You  
Radiating?**

A Roller-Smith type TAW Thermal Ammeter will tell you accurately and it will *continue* doing so. These little 3½" instruments have demonstrated their reliability in the Government service. You can't make a mistake when you use them. Bulletin No. AG-10 is yours for the asking. Send for it. This Bulletin also describes a most complete line of ammeters and voltmeters for *all* radio work.

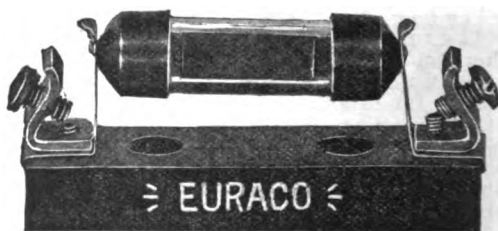
**ROLLER-SMITH COMPANY**  
16 PARK PLACE, NEW YORK

Offices in principal cities in U. S. and Canada

### "Euraco" Mica Condenser

PRICE 60 CENTS

Designed to Fit Standard Grid Leak Base



Composed of Copper and Mica, Entirely Hand Made.

Compact, Interchangeable, Most Efficient

Following Capacities in Stock:

00025 Mfd.—Correct for Super Heterodyne and UV-201.

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0005 Mfd.—Correct for Radiotron UV-200

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**To Get the Most from Your  
Radio Set Use "A" and "B"**

# WESTINGHOUSE

⚡ RADIO ⚡

## BATTERIES

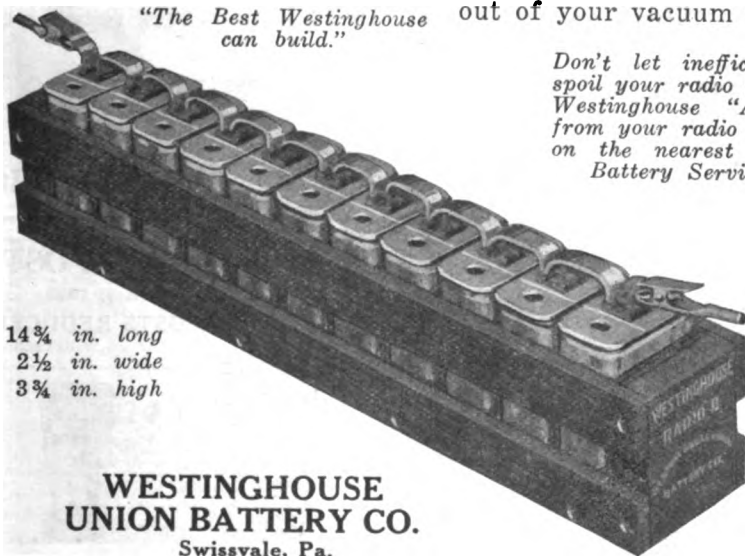


The Westinghouse "A" is a special radio battery, made with a heavy plate and separator to insure long life. It furnishes just the type of strong, steady, constant current of low voltage that radio reception needs. It will stand continuous use without getting "tired."

The Westinghouse "B" is the best answer yet found for "B" battery problems. With occasional recharging it will be constantly full of energy and will last indefinitely.

It is noiseless, clarifies the signals, does not polarize. Its adjustable contact gives adjustable voltage by which you can take the howl out of your vacuum tube.

*"The Best Westinghouse  
can build."*



14  $\frac{3}{4}$  in. long  
2  $\frac{1}{2}$  in. wide  
3  $\frac{3}{4}$  in. high

**WESTINGHOUSE  
UNION BATTERY CO.**  
Swissvale, Pa.

*Don't let inefficient batteries  
spoil your radio pleasure. Get  
Westinghouse "A" and "B"  
from your radio dealer or call  
on the nearest Westinghouse  
Battery Service Station.*

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**ROLL OF HONOR****THESE (and other) INSTITUTIONS USE OUR MOTOR-GENERATORS**

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 Ask for Bulletin 237, Listing Over 200 Combinations.

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**STAMFORD, CONN., U.S.A.****For REAL Service**

Mail your orders to us. We can supply you with the **BEST** at the **BEST PRICES**. Shipments made within 24 hours after receipt of order.

CATALOGUE  
 \$22  
 AT YOUR  
 SERVICE

**THE SERVICE RADIO EQUIPMENT CO.**

Designers—Manufacturers—Distributors

225 SUPERIOR ST.,

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**HERE'S A WELCOME MESSAGE TO USERS OF EBY POSTS**

EFFECTIVE JUNE 1, 1922

**ALL METAL POSTS REDUCED**

ENSIGN H



JUNIOR H



COMMANDER H



SERGEANT



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Get Our Latest Prices.—Deliveries from Stock

**THE H. H. EBY MANUFACTURING CO., 605 ARCH ST., PHILA. PA.**



"Benwood"  
Audio Amplifier

## Full 4 to 1 Amplification Without Howling or Squealing

THE new Benwood Transformer is especially made to get maximum amplification when used with any bulb on the market.

It is completely sheathed in metal, avoiding all inductive effects, so that it gives full 4 to 1 amplification without howling or squealing. The base is  $2\frac{1}{2} \times 3\frac{1}{4}$ ", height only 2"—ideal for either base or panel mounting. The core is best laminated steel, giving highest transference of energy—it will bring in your phone signals loud, strong and clear. The "Benwood" Amplifying Transformer, **\$5.00** each .....

## FINER TUNING— Signals Louder and Clearer

A PROPERLY designed variometer brings in signals very much louder and clearer than the various other types of inductances on the market. With this fact in mind we have designed the "last word" in variometers—the "Benwood." Inductances are wound with double cotton covered wire and no shellac, paint or varnish is allowed to cover the wire and diminish the effectiveness.

The "Benwood" features are—minimum distributed capacity, minimum distance between stator and rotor, large size wire on both coils, positive contact bearings and proper design. This variometer will get splendid results on wave lengths from 150 to 650 **\$5.00** meters with the average variocoupler. Price, each....



"Benwood" Variometer

## The New, Improved "Benwood" Dial Controls

THE "Benwood" dial controls all have solid Bakelite knobs of extra large diameter, which minimize all bodily capacity effects, and the new tapered design fits the fingers perfectly. The knurling is particularly fine and sharp.

### Solid Bakelite Knob and Dial

Graduated 0° to 100°—all markings clearly defined in white and stamped into the solid Bakelite—won't wear off. Rib on reverse side prevents turning too far. Set screw deeply countersunk and easily reached.

|                        | Diam.             | Depth             | Knob              | Each           |
|------------------------|-------------------|-------------------|-------------------|----------------|
| BC-7 "Benwood" control | 4"                | 1 $\frac{1}{4}$ " | 2"                | at base \$2.00 |
| BC-8 "Benwood" control | 3 $\frac{1}{4}$ " | 1 $\frac{1}{2}$ " | 1 $\frac{1}{2}$ " | at base \$1.75 |

Specify whether  $\frac{1}{4}$ " or  $\frac{1}{8}$ " drilling is required.

### Solid Bakelite Knob—Metal Dial

Has the same tapered solid Bakelite knob as BC-7 and BC-8 but has metal dial. Finely graduated from 0° to 180°.

BC-9N "Benwood" control—Nickel Plated Dial 3  $\frac{1}{4}$ " Diam. Each, 80c

BC-9 "Benwood" control—Black Metal Dial 3  $\frac{1}{4}$ " Diam... Each, 80c

Specify whether  $\frac{1}{4}$ " or  $\frac{1}{8}$ " drilling is required.

### Send for Catalog

Send 10c in stamps for the Benwood Catalog and price list, also complete catalog and price list of DeForest Radio Equipment.



### Dealers—

We manufacture high grade apparatus in our own factory, and have stock ready to ship. Write or wire for our attractive agency proposition and liberal dealers' discounts.



1114 OLIVE STREET - ST. LOUIS, MO.



## Hartford Radio Battery

Our radio "A" batteries are up to the Hartford Standard of excellence which means that no battery of any type leaves our plant until it has successfully surmounted a series of careful tests.

|         |                      |         |
|---------|----------------------|---------|
| Type 5R | 30 to 40 Ampere Hour | \$10.00 |
| Type 7R | 45 to 60 Ampere Hour | 12.00   |
| Type 9R | 60 to 80 Ampere Hour | 15.00   |

If there is not a Hartford dealer in your vicinity we will forward a battery direct to you upon receipt of draft or money order.

**The Hartford Battery Mfg. Co. Milldale, Conn.**

## Buy Your Sots and Parts from the Oldest Exclusive Radio Store in Now England!

|   |        |
|---|--------|
| UNIT "B" BATTERIES<br>45V Variable                | \$3.60 |
| CARBON RHEOSTATS<br>Adjust to .01 Amp             | \$1.50 |
| PHONES-HOLTZER CABOT<br>2200 Ohms                 | \$8.00 |
| KEYSTONE LIGHT'G ARRESTORS                        | \$1.75 |
| 600V-100A LIGHT'G SWITCHES<br>Ebony Asbestos Base | \$2.75 |

*We carry at all times a complete stock  
of standard parts at standard prices.*

*Complete Line of Frost Jacks and Plugs.*

**RADIO EQUIPMENT CO.**  
630 Washington St. Boston, Mass.  
MAKERS OF THE RADECO SAFETY FUSE



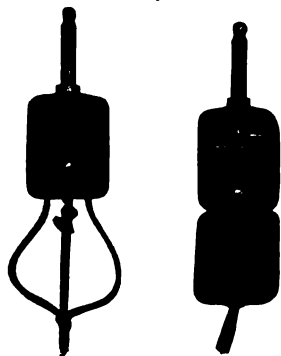
Send 10c for Sample  
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Suite 10  
11 St. Sacramento Street,  
Montreal





No. 2-A Radio Headset  
Price \$7.50



No. 60—Universal Plug  
Price \$1.25



No. 147 Radio Jack \$0.85



No. 148 Radio Jack \$1.00

## Radio Comfort

The thrills of wireless entertainment in the home are enjoyed only where high grade receiving apparatus is installed.

You can ensure the maximum of radio pleasure and comfort by insisting upon having your receiving outfit equipped with—

## Stromberg-Carlson Radio Parts

There is the Stromberg-Carlson "Radio Head Set" with—its pleasing fit, its quick adjustment, its fine tonal qualities and its ability to faithfully reproduce even the faintest long distance signals.

There is the Stromberg-Carlson "Universal Radio Plug" which should be attached to every Head Set. It fits any standard jack, takes any type or size of conductor; takes wire loops, tinsel loops, pin tips or spade tips.

And there are the Stromberg-Carlson "Radio Jacks" which are adapted to all standard radio plugs and which are designed to mount neatly, without washers, on panels that are of varying thicknesses between  $\frac{1}{8}$  and  $\frac{1}{4}$  inches.

Stromberg-Carlson Radio Products are backed by a firm that has had twenty-eight years experience in the design and manufacture of radio and telephone apparatus.

*Order Stromberg-Carlson Radio apparatus through your dealer in electrical merchandising or write for free Bulletin No. 1029-Q.*

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Rochester, New York

Chicago

Address Nearest Office

Kansas City

# EVERYTHING Radio!

Our experience as representatives of all the popular makes of Radio apparatus enables us to render the best possible service.

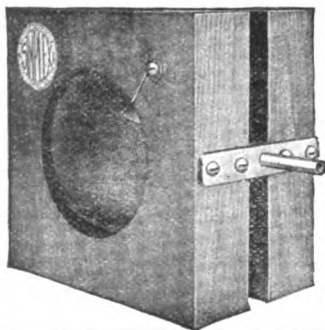
We are authorized Radio Corporation jobbers, including the famous Westinghouse Receivers and New General Electric Receivers.



## PHILADELPHIA WIRELESS SALES CORP.

1533 Pine Street, Philadelphia

### VARIOMETERS AND VARIOCOUPERS



These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base.

Variometer as illustrated ..\$6.00

Vario-Coupler as illustrated 6.00

Round or Square Base

Get them at your dealer's.

**SIMPLEX RADIO CO.**

1013-15 Ridge Av., Phila. Pa.



## P O S A C O

### RADIO INSTRUMENTS OF QUALITY VARIABLE CONDENSERS

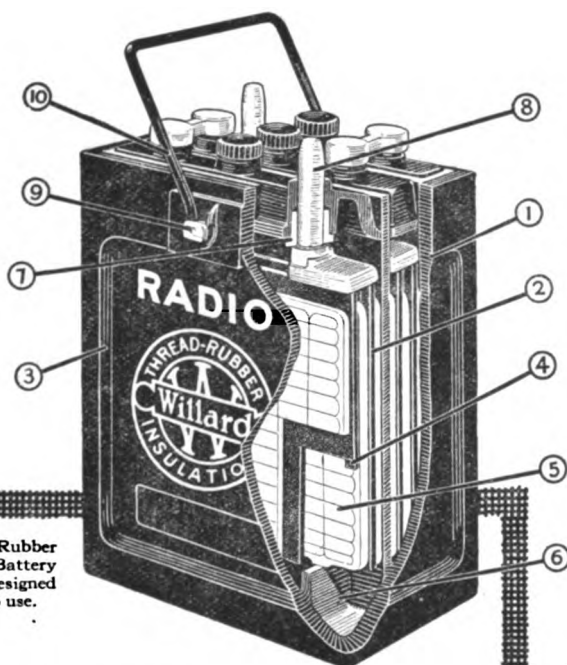
Our Condensers are all made with 4 1/2 inch diameter metal shield with terminal for ground connection. Rotary Plates cannot turn on post even should nut become loose. For panel mounting.

|     |          |        |               |        |
|-----|----------|--------|---------------|--------|
| A-1 | 43 Plate | .001   | Mfd. Capacity | \$4.75 |
| A-2 | 23 Plate | .0005  | Mfd. Capacity | \$3.75 |
| A-3 | 13 Plate | .00025 | Mfd. Capacity | \$2.75 |

SPECIAL DISCOUNT TO DEALERS AND JOBBERS

**THE C. D. POTTER CO.**

583-585 PACIFIC STREET, STAMFORD, CONN.



The Willard All-Rubber Radio "A" Battery (shown here) is designed especially for radio use.

## Ten Reasons Why The Willard All-Rubber Radio "A" Battery is Better

These reasons, back of the success of this specially designed battery, are as definite as those responsible for the success of the Willard Threaded Rubber Battery, which is now standard original equipment on 195 makes of cars and trucks. Ask for particulars from your dealer or at the nearest Willard Battery Station.

The Willard Radio "B" Battery is a 24-volt rechargeable storage battery, with leak-proof glass jars and Threaded Rubber Insulation. Assures freedom from frying and hissing ground noises.

**WILLARD STORAGE BATTERY CO.**  
Cleveland, Ohio

*Made in Canada by the*

Willard Storage Battery Company of Canada, Limited, Toronto, Ont.

**Willard** THREADED RUBBER BATTERY

**1** The rubber case is made in one piece, thoroughly insulating the battery from cells to ground and from cell to cell, and effectively preventing all ground noises.

**2** Plates are insulated with Threaded Rubber Insulation, which by reason of its uniformity allows every part of each plate to do an equal share of work.

**3** Battery is shipped in absolutely Bone-Dry condition so that it is brand new when you get it.

**4** Insulators are made with special heavy ribs to meet the special requirements of the radio battery.

**5** Plates are extra heavy to provide current at steady voltage for considerable periods.

**6** Sediment chambers are large to eliminate all possibility of short circuits at plate bottoms.

**7** Posts are sealed by soft rubber gaskets, so that solution cannot seep out between post and cover.

**8** Terminal posts are high to permit easy grip of battery clamps.

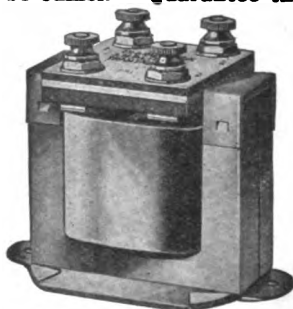
**9** Brass knobs sunk into the sides of the rubber case provide a firm hold for the handle.

**10** Handle made of a heavy rod furnishes easy means of carrying the battery.

# THE THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMER

is now standard with many well known manufacturers  
That should be sufficient guarantee that it is right

**SHELL  
TYPE**



**PRICE  
\$4.50**

Each transformer supplied fully mounted in an ingenious, nickeled frame with substantial terminals mounted on a bakelite terminal board.

The terminal board is on the top, the only logical place for a terminal board. The transformer is wound with silk covered wire.

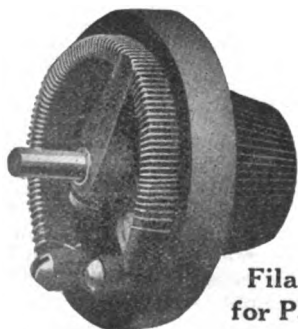
**BACKED BY THE "GOLD MEDAL" LINE**

**PRICE, AS ILLUSTRATED - - - \$1.50**

**Thordarson Electric Mfg. Co.**

**500 WEST HURON ST. COR. KINGSBURY,**

**CHICAGO**



**No. 100  
Filament Rheostat  
for Panel Mounting**

**No Magnetic Material Used in its  
Construction**

This new rheostat consists of a resistor of special non-corroding alloy inserted in a molded base of high insulating and heat resisting properties,—genuine Thermoplas. Each turn of the resistor is anchored firmly in place so that there is no chance for noisy or scratchy operation. All metal parts are nickeled.

If you cannot obtain CRL Rheostats from your local dealer, send \$1.00 plus 10c for carriage.

List Price (East of the Rocky Mountains) \$1.00  
Dealers and Manufacturers of Radio Equipment are invited to communicate with us.

Immediate shipments

**Central Radio Laboratories**

**303. 16th Street,**

**MILWAUKEE, WISCONSIN**

## NOVO "B" Batteries



**NOISELESS — DEPENDABLE —  
GUARANTEED**

**All Standard Sizes—Plain and  
Variable**

**22½-45 & 105 Volts**

**NOVO  
MANUFACTURING CO.**

**424 W. 33rd St.**

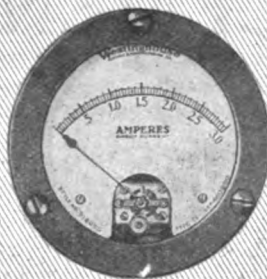
**NEW YORK**

**531 So. Dearborn St.**

**CHICAGO**



Type BX



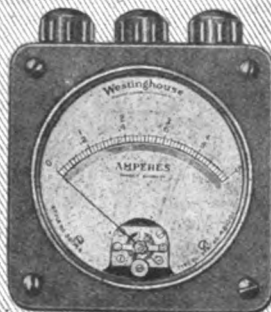
Type CX



Type BX



Type PX-2



Type PX-3

## EVERY RADIO SET

Should have its proper equipment of

### Westinghouse Measuring Instruments

**The D-C. Ammeter** in the filament circuit indicates the current flowing through the filament, thus avoiding overloading. It prolongs the life of the filament, reducing expense. Also, it facilitates duplicating previous settings, irrespective of a change in battery voltage.

**The D-C. Voltmeter** gives a sure indication of the condition of the battery.

**The Radio Frequency Ammeter** tells at a glance the amount of electrical energy being radiated, thus showing the strength of the signals.

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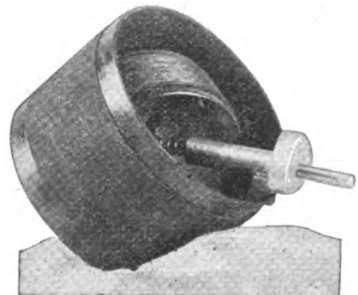
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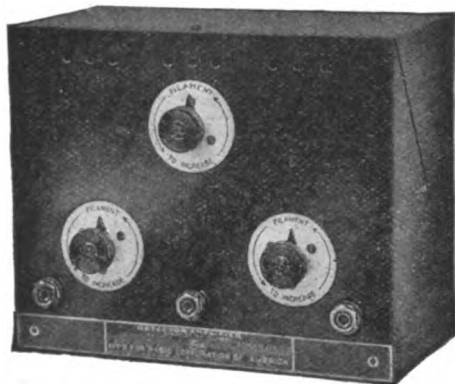
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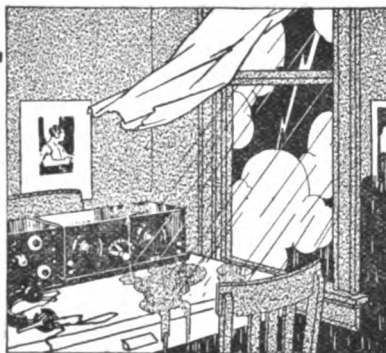
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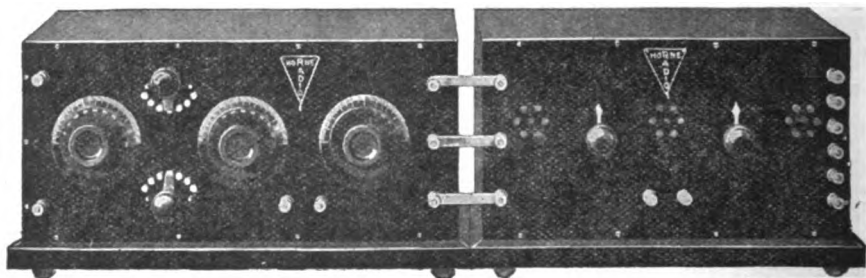
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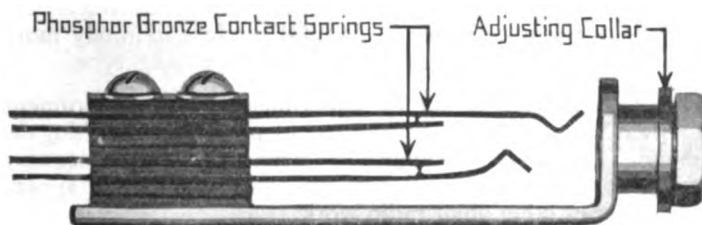
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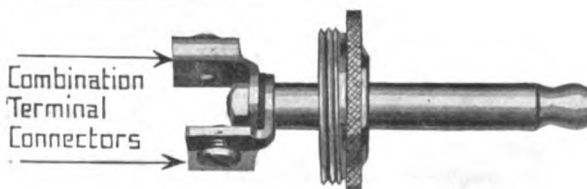
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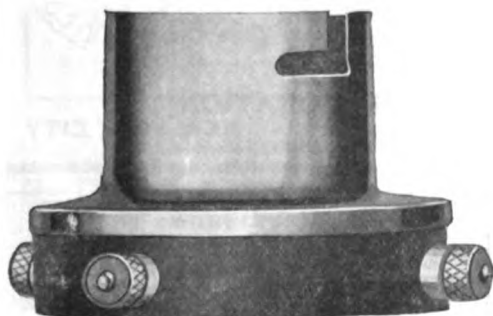
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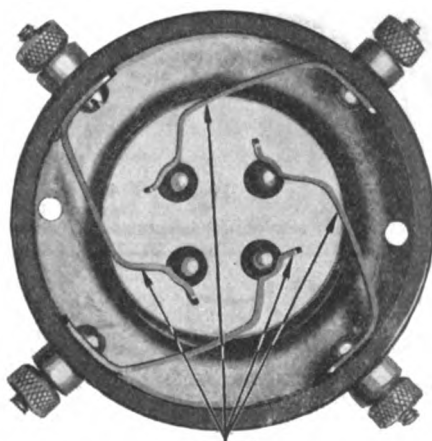
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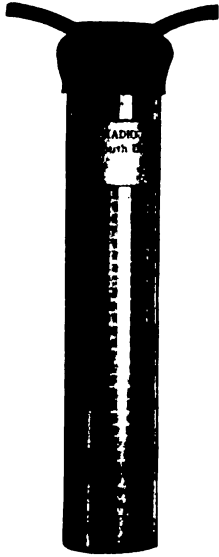
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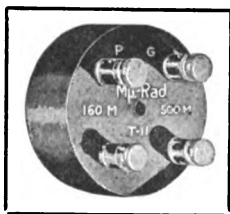
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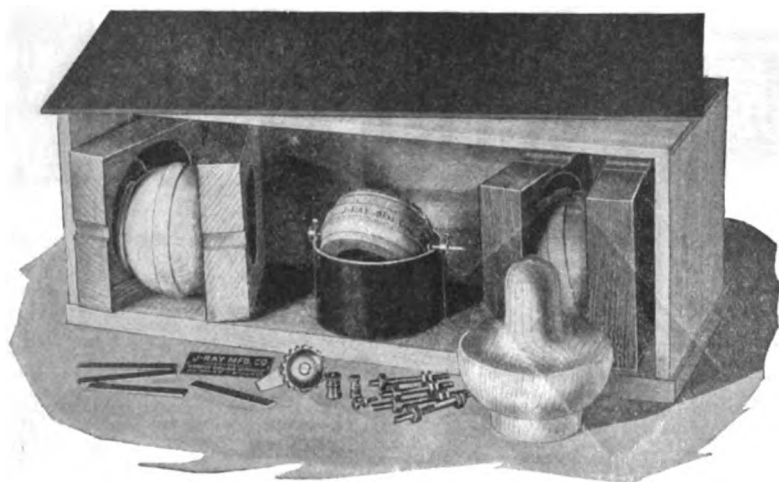
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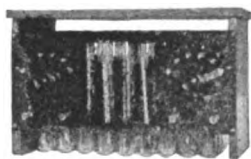
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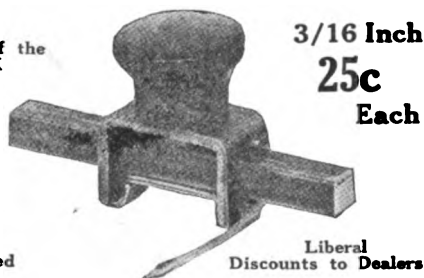
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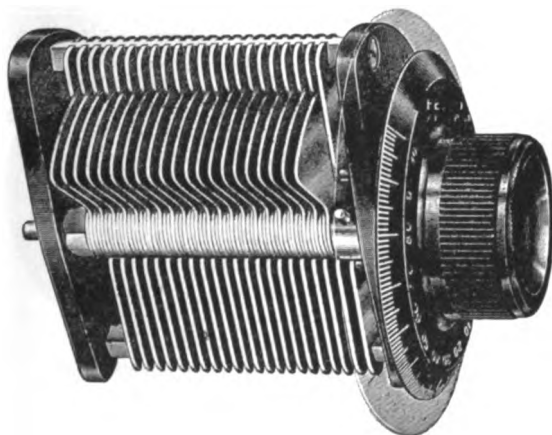
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Phones on hand for immediate shipment. Ask us for the phone you want. *Special*—100-ohm single receivers made by old reliable telephone maker. List—\$2.50. *Agents Wanted Everywhere.* Get literature and discount sheet.

**B. E. Polczynski & Co.**

66 Capitol Bldg., 1550 Broadway  
Detroit, Michigan U. S. A.

# CONDENSERS



|               |        |
|---------------|--------|
| 3 Plate.....  | \$2.25 |
| 11 Plate..... | 3.25   |
| 23 Plate..... | 4.00   |
| 43 Plate..... | 4.75   |

Add 75c to above list for condenser with dial.

## CAPACITY

|                      |        |
|----------------------|--------|
| 3 Plate vernier..... | .00004 |
| 11 Plate.....        | .00025 |
| 23 Plate.....        | .0005  |
| 41 Plate.....        | .001   |

Each condenser is equipped with ground shield which eliminates all hand capacity losses. No accumulated error due to poorly cut spacing washers.

BAKELITE

## DIALS

BAKELITE

Furnished in either 3/16 or 1/4 inch shaft sizes. 3" outside diameter with large and clear numerals. 0-100 degrees.  
Price .....\$1.10



This dial is made of genuine bakelite and is guaranteed not to warp. The knob is knurled to prevent slipping of fingers.  
Price .....\$1.10

**STERN & COMPANY, Inc.**

308 Asylum St.,

Hartford, Conn.

Catalog 10c.

**F E S C O**

Dealers Propositions  
Entertained

# RHAMSTINE ★ PRODUCTS

May be purchased with assurance that they will give complete satisfaction. Each is guaranteed to do so.

**Go To Any Good Dealer in Radio Supplies and Purchase**

Definite evidence of their superiority is revealed in the knowledge that Rhamstine\* design has been imitated; but Rhamstine\* craftsmanship has not been equalled.

*Folder showing the Rhamstine\* line of Radio products will be sent on request.*

## THE GENUINE RHAMSTINE★ PRODUCTS

Plugs and Jacks  
Amplifying Transformers  
V. T. Sockets  
V. T. Batteries  
The Adapt-O-Phone  
Modulation Transformers

Manufactured By

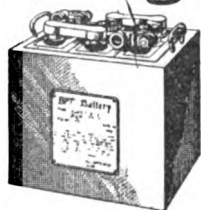
**J. THOS. RHAMSTINE ★**

2152 E. LARNED STREET,

DETROIT, MICHIGAN

\*Maker of Radio Products

# Bridgeport Storage Batteries



**A Special Battery for Radio Work**

**Guaranteed for One Year**

**6 Volts 40 A. H. \$10.00**

**6 Volts 60 A. H. \$12.00**

**Bridgeport Storage Battery Co.**

**35 Remington Street**

**Bridgeport Conn.**

## REX GALENA CRYSTALS

Direct from Mine of Highest Grade  
Galena Produced

We select crystals which are most quickly and acutely alive to impressions.

**12c and 25c Sizes**

Manufacturers and Dealers, get our Special Discounts

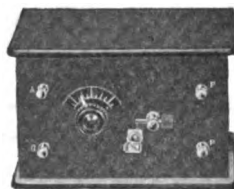
Demand the REX Galena Crystal. Once used, always used. Your orders filled promptly

**EMPIRE ELECTRIC MACHINERY COMPANY**

501 Pennsylvania Ave., Joplin, Mo.

## "SUPERIOR" RECEIVING SET

**\$4.75**



In Cabinet complete as shown

Guaranteed to bring in signals as loud or louder than any other crystal set made, regardless of price. We will prove this to your satisfaction or refund your money.

Parts For "SUPERIOR" set ready for assembling

**\$3.25**

GENUINE "STEINMETZ" TESTED GALENA  
Absolutely the most sensitive that can be had.

In sealed tin box, 15c.

At your dealers or

STEINMETZ WIRELESS MFG. CO.  
5706 Penn Avenue, Pittsburgh, Pa.

# Signal is Not "Side-Line"

## Wireless Apparatus



In the days of rapid Radio development, many companies, with an eye to the "easy markets" have brought out Radio equipment as a sort of "side-line".

"Side-Line" apparatus is the kind to "side-step," if you want to take pride in your outfit and you are building for permanency.

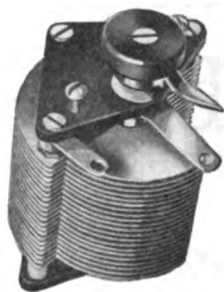
Whether you are in Radio for profit, or pleasure, it is good to know that

## SIGNAL WIRELESS APPARATUS

is manufactured according to best commercial and government standards—by a company specializing in Radio equipment. SIGNAL Wireless Apparatus has been developed by Signal Radio experts in Signal Laboratories—and is *built for business*.

### SIGNAL BACK MOUNTED VARIABLE CONDENSER

You can drop Signal Condensers, No. 76 & 77, to the floor from a considerable height without damaging plates or spoiling adjustment. They are rigidly built. Instead of using aluminum but .015" in thickness for the plates, as is usual with ordinary amateur construction, Signal plates are .026" thick.



## SIGNAL ELECTRIC MANUFACTURING COMPANY

Menominee,

Michigan

**Cut Out and Mail Coupon Now**  
New Signal Wireless Bulletins describing Signal Wireless Apparatus are free for the asking. Simply fill in and mail this request-coupon.

### COUPON

Send me the new Signal Wireless Bulletin W.

Name .....

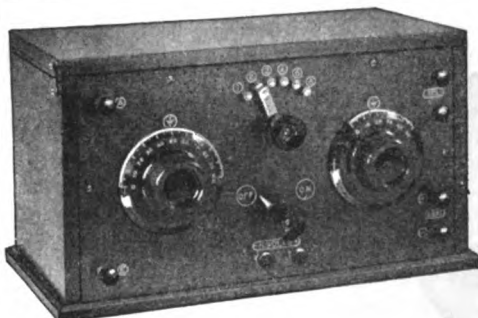
Company .....

City .....

State .....

# TUSKA

**Type  
224**

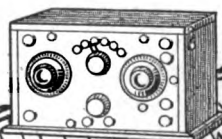


**Price  
\$35.00**

**Tuska Regenerative Tuner—ready for Tube, Phones, and Battery. The ideal outfit for expert or beginner. Two knobs: one for wave length; the other for amplifying. Type 224 has stood the test of public trial.**

Send 5c. for New Tuska Catalog No. 3.

**THE C. D. TUSKA CO.**  
38 HOADLEY PLACE, HARTFORD, CONN.



**Bradleystat**  
REGISTERED U.S. PAT. OFF.  
**PERFECT FILAMENT CONTROL**



**PRICE — \$1.85**  
at radio dealers  
Postage 10c extra

**“A Wonderful Improvement”**

writes a Bradleystat user

*“Replaced my wire-wound filament rheostat with a Bradleystat and now get absolutely smooth control without frying or steps.”*

Write us. We have a valuable bulletin. It describes the latest improvement in bulb filament control.

**Allen-Bradley Co.**

Electric Controlling Apparatus  
277 Greenfield Av., Milwaukee, Wis.

**SEND YOUR  
ORDERS TO**

**MISSOURI**  
RADIO SUPPLY  
*“Service Original”*

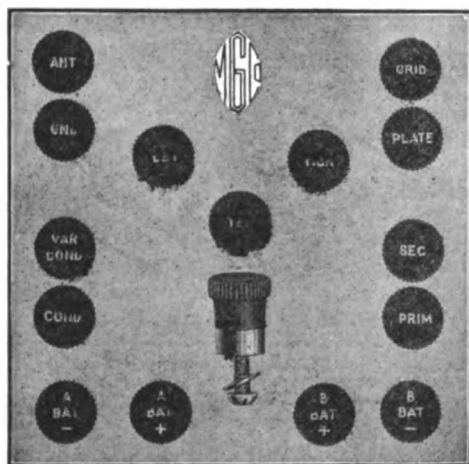
**A COMPLETE STOCK  
TO SERVE  
EVERYBODY IN RADIO**

**MISSOURI RADIO  
SUPPLY COMPANY**

**4623 MARYLAND AVE.,  
ST. LOUIS, MO.**

# “Read ’Em” Binding Posts

*“Radio’s Greatest Convenience”*



**17 Styles—Packed in Cartons 25 to 50 Each Style**

Antenna  
Tickler  
Secondary  
A-Battery—  
A-Battery +  
Variable Condenser

Ground  
Plate  
Phones  
Grid  
B-Battery—

Condenser  
Detector  
Primary  
Filament  
B-Battery +

**A Positive and B Negative Battery Posts**

## QUALITY

The quality built into every post is consistent with the high Marshall-Gerken standard. “Read-Em” binding posts are a distinct aid to correct hook-up and add materially to the appearance and efficiency of any set. They are standard with discriminating users.

**Complete Post and Knob 15c each**

**Ask for “Read ’Ems” at Your Dealers**

*The Marshall-Gerken Co.*

Quality **RADIO** Products  
MANUFACTURERS—DISTRIBUTORS  
Toledo, Ohio, U. S. A.

# WHITALL ELECTRIC CO., WESTERLY, R. I.

## IMMEDIATE DELIVERY

Clapp-Eastham HR and HZ sets in the new mahogany cabinets list \$40.00 each LIST

|   |        |
|---|--------|
| Clapp-Eastham Variometers with dial   | \$6.50 |
| Clapp-Eastham HRF Sets 175-600 meters   | 35.00  |
| Clapp-Eastham HRA one stage amplifiers  | 15.50  |
| Federal Telephones Type 2200 Ohms   | 8.00   |
| King Amp-li-tones   | 12.00  |
| Electrose Insulators, all types   |        |
| WECO All Moulded Bakelite Sockets   | .75    |
| WECO Rheostat Dials, latest production, 1/4" shaft  | .90    |
| WECO 3" Dial for variometers, etc., 1/4 or 1/2" shaft   | 1.00   |
| Electrose Dials Type S, 1/4" shaft  | 1.50   |
| New style Antenna Wire, 16 strand braided cable, will greatly increase both receiving and transmitting range, has very large conducting surface, per C. | 2.50   |
| ACE Batteries, any style  |        |
| BRACH Lightning Arresters, inside type  | 2.50   |
| Western Electric Telephones   | 12.00  |
| Paragon Sockets Type No. 50   | 1.00   |

We are distributors for Radio Corporation, Clapp-Eastham, Federal, Ace, Remler, Baldwin, Chelsea, Conn. Tel. & Elect. Co., Eveready, Witherbee, DeForest, Electrose, General Radio, Frost, Murdock, General Apparatus, Wireless Press, Consolidated Call Book Company, King Amp-li-tone and many others.

Dealers write for discounts on above material, and our catalogs.

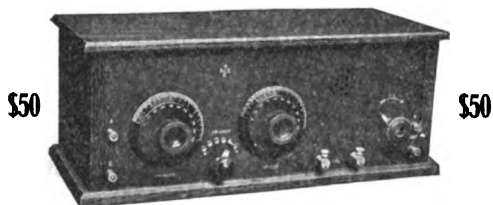
QUALITY



SERVICE

"YOU WILL LIKE TRADING WITH US"

If QUALITY counts, bear in mind that ACE equipment speaks for itself. An Ace type TRU Concert Receptor can be placed in your parlor, and is in a class with your piano or finest phonograph.



Licensed under Armstrong Patent No. 1,113,149

For electrical efficiency we claim our TRU to be equal or superior to any similar equipment now on the market.

A very important point to be considered in purchasing a Concert Receiver is the proposed change of wave lengths of broadcasting stations. The majority of Radio receivers now on the market would be worthless should this change be effected. Our receiver is arranged for immediate adaption to this change by even a most inexperienced person.

Better investigate—we have literature for the asking.

**THE PRECISION EQUIPMENT CO.**  
2437-39 Gilbert Ave., Cincinnati, Ohio

## IN DETROIT

*The Radio Center*  
THE SAY "NATIONAL!"

for  
Transmitting and Receiving  
Equipment  
**DISTRIBUTORS**

A complete stock of high-grade  
Radio sets and Radio Equipment

PANELS MACHINE CUT TO SIZE

**Mail Orders Filled  
Promptly and Accurately**

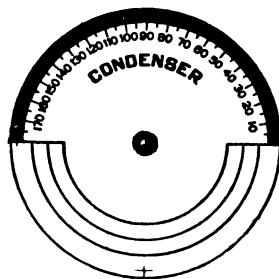
A 20% deposit required on every  
order. Satisfactory service assured.  
Write today!

*Every consideration given to dealers.*

**NATIONAL** Electric Supply  
and Fixture Co.  
1338 Broadway, DETROIT, MICH.

"Nationally Known for Radio"





The dials here illustrated are of German Silver, made according to Government Specifications. Anti-capacity type, illustrations  $\frac{1}{2}$  actual size.



|                                   |        |
|-----------------------------------|--------|
| Variocoupler Dial.....            | \$1.20 |
| Grid Variometer Dial.....         | 1.40   |
| Plate Variometer Dial.....        | 1.40   |
| Condenser Dial.....               | 1.20   |
| Condenser Dial, without knob..... | 0.90   |

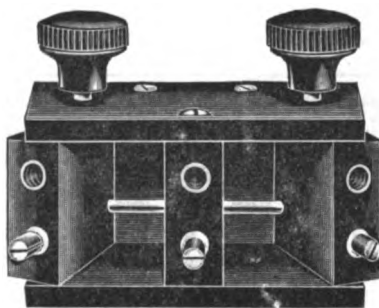
#### BAKELITE

Genuine XX Bakelite, all sizes and widths, cut according to your requirements.....**\$2.25** per lb.  
Cabinets 6x6x12 .....**\$2.50** up

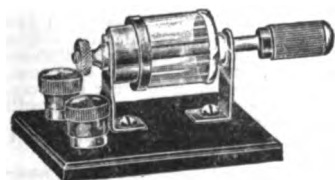
#### Aetaco Inductance Coil Mounting

The AETACO 3 Coil Inductance Coil Mounting is manufactured from Genuine XX Bakelite—not moulded. Consists of three Bakelite standard plugs held in place by Bakelite frame. Plugs mounted on bearings allows for changing coupler between coils. All metal parts nickel plated. Connecting wire soldered on rear of plugs makes connection easy. Shipping wt. 1 lb.

**PRICE** .....**\$5.00**



#### New Model Aetaco Crystal Detector



The AETACO new model Crystal Detector is mounted on Genuine Bakelite XX Grade base—not moulded. Double rubber tip binding posts. Supplied with a super-sensitive mounted galena crystal. Over-all dimensions of detector  $2\frac{1}{2}$ "x2"x2". Net wt.  $\frac{1}{4}$  lb. Shipping wt.  $\frac{1}{2}$  lb.

**PRICE** .....**\$2.00**

*Write For Catalog!*

## American Electro Technical Appliance Co.

227-229-235 FULTON STREET,

NEW YORK CITY

# DEALERS GET SPECIAL PROPOSITION

Send to KLAUS—"Radio Headquarters" for special discount lists and bulletins on apparatus and equipment. Our service department offers dealers assistance and advice on radio problems. We distribute "tested" apparatus. We know the equipment we send you is right. We want all Agents and Dealers to get our special proposition on the best lines of apparatus made.

Get our Prices on these lines of apparatus

Acme  
Adams-Morgan  
Baldwin  
Brandes  
Westinghouse

Clapp-Eastham  
DeForest  
Jewell  
Federal  
Radio Corporation

Grobo  
Moorhead  
Murdeck  
Pacent

Write today to---

**KLAUS RADIO CO.**

Dept. 100

Eureka,

Illinois

**FIRST TESTED THEN SOLD**

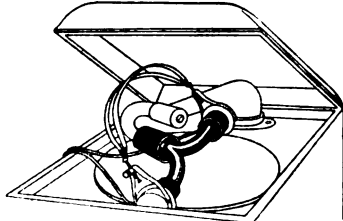
## PHONOTACH

Makes Your Phonograph a  
Radio Loud Speaker

(Trade Mark)

**IT SPEAKS FOR ITSELF**

Adjust It in a Minute



Patent Applied For  
**A NEW AND BETTER LOUD SPEAKER**  
at a very low cost

The PHONOTACH connects the receivers with the tone arm of your phonograph. Utilizes the scientifically designed tone amplifier of the talking machine to secure mellowness and beauty of tone in Musical and talking programs received over radio apparatus.

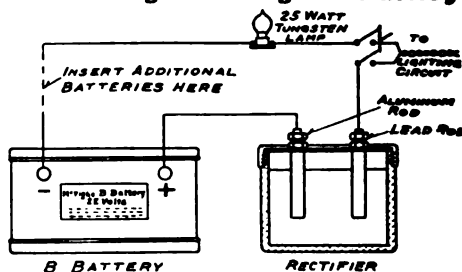
**PRICE—\$3.00**

Send for one to-day.

**W. A. MILLS**

103 Park Ave., New York, N. Y.  
At your dealer or by mail

## The McTighe Storage B Battery



The McTighe Storage "B" Battery is of the alkaline type, is the most satisfactory source of plate potential, and can be charged from your lighting circuit for less than one cent. Can also be charged from farm lighting systems. In ordinary service a one hour charge will last for several weeks.

The Battery is furnished in a 24 volt unit in an attractive case.

It is noiseless, and cannot be injured by accidental short circuit, overcharging or by standing idle.

Descriptive Leaflet on request

### PRICES

|                     |        |
|---------------------|--------|
| Battery .....       | \$4.00 |
| Rectifier .....     | 1.50   |
| Rubber Filler ..... | .25    |

F. O. B. Irwin, Pa.

**ECONOMIC APPLIANCE COMPANY**

Successor to

**McTIGHE BATTERY COMPANY**  
Irwin, Pa.

May 1, 1922

# Warning to Patent Infringers

Various types of crystal detectors, renewals therefor, and crystal detector radiophone receiving sets now being offered for sale employ the inventions of one or several of the following United States patents (commonly referred to as the Pickard patents) the property of the Wireless Specialty Apparatus Company.

|                             |           |           |
|-----------------------------|-----------|-----------|
| 836,531                     | 904,222   | 924,827   |
| 886,154                     | 912,613   | 1,104,073 |
| 888,191                     | 912,726   | 1,137,714 |
| 13,798 (reissue of 877,451) | 963,173   | 1,225,852 |
| 933,263                     | 1,104,065 | 1,257,526 |
| 1,213,250                   | 1,118,228 | 1,136,044 |
| 1,136,045                   | 1,136,046 | 1,136,047 |

The above patents cover, among other things, the most efficient circuit arrangement of apparatus commonly used in crystal detector radiophone sets, various kinds of crystal members, means for mounting the crystals and holding the mounting, special forms of contacting conductors for the crystals, and mechanism permitting the user's selection of contact points of the contacting conductor on the crystals.

Authorized crystal detectors now are available through the distributors of the Wireless Specialty Apparatus Company, also renewals therefore, and complete crystal detector radiophone receiving sets, all in large quantities, which are sold under the various above-mentioned patents.

The Wireless Specialty Apparatus Company purposes to prosecute, vigorously, all infringers of its patents, and therefore, those manufacturers, distributors, jobbers and dealers who have not been authorized as yet are warned to cease the manufacture or the sale or distribution of crystal detectors, renewals therefor, or crystal detector radiophone receiving sets or any other radio devices which infringe these patents.

Unauthorized distributing or selling, wholly independent of manufacturing, is just as much an infringement as the manufacturing itself, and any seller is separately liable to suits for accounting for damages or profits in addition to injunction.

For their own protection, the distributors, jobbers and dealers who yet may be offering for sale unauthorized crystal detectors, renewals therefor, or complete crystal detector radiophone receiving sets, should demand a guarantee from the manufacturer from whom they purchase radio equipment holding them harmless in case of damage suits arising through their distribution and sale of radio apparatus which infringes the above-mentioned patents.

Crystal detectors, renewals therefor, or crystal detector radiophone receiving sets made and sold with the authorization of the Wireless Specialty Apparatus Company can be readily identified by the data of the above patents and restriction notices prominently marked on the apparatus.

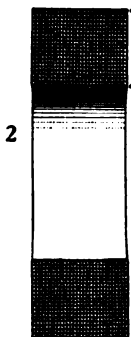
**Wireless Specialty Apparatus Company**  
**BOSTON, MASS.      Established 1907      U.S.A.**

# GIBLIN-REMLER

## A NEW COIL DEVELOPMENT

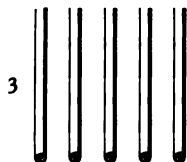


Assume that the above single layer coil consists of 1000 turns and that the capacity between turns is  $Y$ . Then  $1000 Y$  is the total self capacity of this inductance.



20 layers high  
50 turns per layer  
 $20 \times 50 = 1000$  turns

Reduce the length of coil 1 by winding a multi-layer compact inductance of 1000 turns (20 layers of 50 turns). The inductance will be greater than coil 1 due to the greater mean diameter of the turns. The capacity between turns is still  $Y$ , but an additional capacity between layers equal to  $50 \times Y$  (the mean of the number of turns in each two layers) has been added. This increase in internal capacity makes the coil unsuited for use as an inductance.



The capacity between layers and between turns is reduced by spacing, but this results in a loss of inductance.



Maximum inductance is obtained by winding the turns close together. This is the method used in the new Giblin-Remler Inductance, combined with a new method of separating the layers.



## GIBLIN'S NEWEST AND GREATEST DEVELOPMENT OF A COMPACT INDUCTANCE COIL

Thomas P. Giblin, originator of the Honeycomb and Duo-Lateral Coils has been working for years to produce an even more efficient inductance coil. Success has at last been achieved in the Giblin-Remler Inductance Coil.

**REMLER RADIO MFG.**

248 FIRST STREET, SAN FRANCISCO, CAL.

E. T. Cunningham, General Manager



# THE NEW REMLER COIL MOUNTING

**SIMPLE TO MOUNT. TIGHTENING BAND BUILT INTO MOUNTING. ELIMINATES FIBER BAND. MOLDED BAKELITE. INTERCHANGEABLY USED WITH REMLER COIL AND PANEL TYPE PLUGS.**

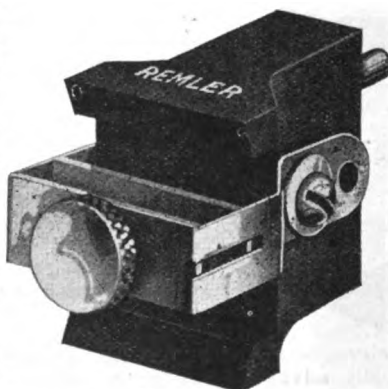
The plug terminal is slotted twice at right angles, insuring smooth, easy plugging

The tightening band is nickel plated. Three holes provide the necessary adjustment and prevent any slipping.

The plug is molded bakelite, buffed finish. The contour is shaped to the coil.

The solder terminals are countersunk, eliminating possible injury to coil winding.

The slot in the tightening band holds the pressure plates in alignment.



The plug and jack terminals are interchangeable with all standard plug and panel mountings.

The tightening band is securely held to the plug

The lower plate absorbs the pressure on the coil

The upper plate applies tension to the tightening band parallel to the sides of the coil

A turn of the thumb screw separates the pressure plates and securely clamps the coil to the plug

This new Remler Coil Mounting with its improved and original features is built especially for the new Giblin-Remler Coils. The plug can be used interchangeably with all Remler coil and panel type plugs.

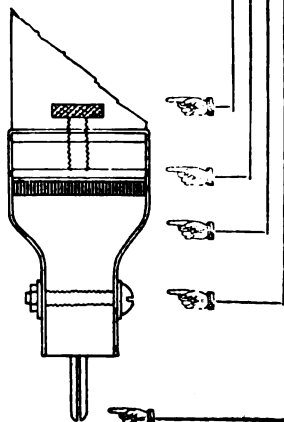
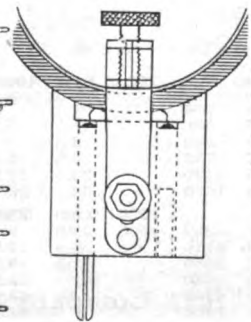
The metal tightening band—an important Remler feature—eliminates the annoying fibre band and assures perfect tightness at all times. By simply turning the thumb screw the coil is rigidly fastened to the coil contour of the bakelite plug. There is no fibre band to become damp and stretch or to loosen the coil from its mounting.

Built complete by Remler, every operation is checked to insure a smooth working, simple operated plug—a plug with a Remler Guarantee.

## PRICE

No. 48—20 to 750 turn coils 70c  
No. 49—1000 to 1500 turn coils 80c

Amateurs:—Write for catalogue and name of nearest Remler Dealer.



## REMLER RADIO MFG. COMPANY

248 First St.,  
San Francisco, Calif.

E. T. CUNNINGHAM,  
General Manager

154 W. Lake St.,  
Chicago, Ill.

# Radio panels *and radio parts*

Start right. The panel is the very foundation of your set. High volume and surface resistance are essential factors. Make sure that you get them in both the panel and parts that you purchase. To make doubly certain look for the dealer displaying this sign

**CONDENSITE  
CELORON**

**Radio Panel Service**

Condensite Celeron Grade 10—approved by the Navy Department Bureau of Engineering—is a strong, handsome, waterproof material, high in resistivity and dielectric strength. It machines easily, engraves without feathering and is particularly desirable for panels. It is also widely used for making many other important radio parts such as tube bases, platform mountings, variable condenser ends, tubes for coil windings, bases, dials, knobs, bushings, etc. We are prepared to make these various parts to your own specifications.

Where economy is a factor we can supply panels of Vulcanized Fibre Veneer made of hard grey fibre veneered, both sides with a waterproof, phenolic condensation product. This material has a hard, smooth, jet-black surface, machines and engraves readily and will give excellent service where very high voltages at radio frequencies are not involved.

Shielded plates (patent applied for) are made with a concealed wire shield. This shield, when properly grounded, effectively neutralizes all howl and detuning effects caused by body capacities.

**Send today for our Radio Panel Guide**

Are you an enthusiast? This Guide describes our panels in detail—gives tests—and tells just how much the panel you want will cost.

Are you a Radio Dealer? Let us tell you how easily and profitably Celeron Radio Panel Service enables you to supply your customers with panels machined and engraved to their specifications. Write today for our Dealer's Proposition covering panels, dials, knobs and tubes.



**Diamond State Fibre Company**  
**Bridgeport (near Philadelphia), Pa.**  
**Branch Factory and Warehouse, Chicago.**

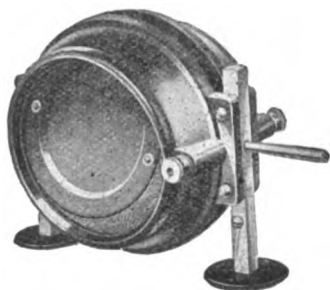
Offices in principal cities

In Canada: **Diamond State Fibre Company of Canada, Ltd., Toronto.**

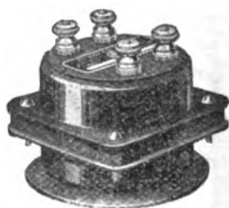
CONDENSITE  
**CELORON**

# ATWATER KENT

## RADIO APPARATUS



**VARIOMETER**



**TRANSFORMER**

These Variometers and Transformers have been developed in the research laboratory of the Atwater Kent Manufacturing Company. Twenty years' experience in the manufacture of electrical instruments of accuracy and precision, assures the highest possible standard of quality and performance in these sets.

Manufactured complete in our plant, from the moulding of the condensite forms to the winding of the fine wire coils.

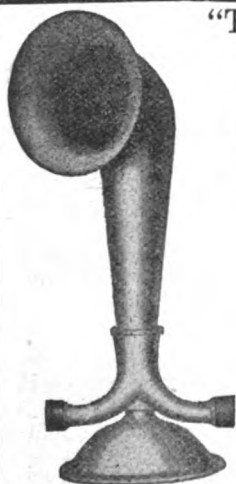
Correspondence solicited.

### ATWATER KENT MANUFACTURING COMPANY

4945 STENTON AVENUE,

RADIO DEPARTMENT

PHILADELPHIA, PA.



### "The Bridgeport"

"The Horn of Pure Tone"

**\$8.00**

A  
LOUD SPEAKER  
MADE  
ENTIRELY  
OF  
PURE CAST  
ALUMINUM

THE  
ONLY  
LOUD SPEAKER  
ELIMINATING  
ALL  
SHEET METAL  
PARTS

BRIDGEPORT HORNS give maximum of amplification.

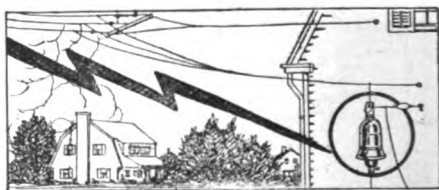
BRIDGEPORT HORNS reproduce without distortion. BRIDGEPORT HORNS can be turned in any direction without moving base.

BRIDGEPORT HORN AND BELL cast in one piece. BRIDGEPORT HORNS equipped with special receiver protector.

BRIDGEPORT HORNS FINISHED IN DULL BLACK RUBBERIZED FINISH.

Height 17 1/2" Dia. of Bell 6" Delivered in U. S. on receipt of price and 50 cents postage.

Manufactured by  
THE MONUMENTAL BRONZE COMPANY  
Radio Dept. Bridgeport, Conn.  
ATTRACTIVE PROPOSITION TO DEALERS



## Brach Vacuum Lightning Arresters

### FOR RADIO PROTECTION

Most sensitive, most positive safeguard against lightning and static.

Operate automatically, cannot become grounded, nor clogged with dirt.

No weak or lost signals.

Approved by

National Board of Fire Underwriters

Electrical No. 3962

On Sale By Leading Dealers

**L. S. BRACH MFG. CO.**  
NEWARK, N. J.

16 Years Specialists in Lightning Protective Apparatus



# RADIO APPARATUS

*Distributors of Reliable Radio Apparatus to Schools, Colleges, Radio Clubs and Experimenters all over the World!*

**"PITTSCO"**

**Specializing on "RADIO  
CORPORATION'S"  
Products**



**"PITTSCO"**

**Now has three Stores.  
Send us your orders!**

The present tremendous demand for Radio Apparatus has practically made it impossible for us to render our usual SERVICE. Reasonably prompt delivery, however, can be made on the items listed

## AMPLIFYING TRANSFORMERS

|                                     |        |
|-------------------------------------|--------|
| No. P-1 General Radio, semi-mounted | \$5.00 |
| No. 50 Chelsea, semi-mounted        | 4.50   |
| No. A-2 Acme, semi-mounted          | 5.00   |

## ANTENNA WIRE

|   |      |
|---|------|
| "Pittsco" #14 hard drawn copper, (80 ft. per lb.) per lb. | .40  |
| 500 ft. (Special value)                                   | 2.25 |
| "Pittsco" 7 strand #22 tinned copper, per ft.             | 0.01 |
| 500 ft.   | 4.00 |
| 1000 ft.  | 7.50 |
| "Pittsco" 7 strand #20 Phosphor bronze per ft.            | 0.02 |
| 500 ft.   | 7.50 |

## ANTENNA INSULATORS

|  |     |
|--|-----|
| No. P-1 Electroze Ball insulator           | .35 |
| No. P-2 Electroze 4 inch strain insulator  | .45 |
| No. P-3 Electroze 10 inch strain insulator | .75 |

## "A" BATTERIES (Storage Batteries)

|                             |       |
|-----------------------------|-------|
| Yale 6 volt 60 Ampere-hours | 18.00 |
| Yale 6 volt 80 Ampere-hour  | 21.00 |
| Yale 6 volt 100 Ampere-hour | 25.00 |

Note—These batteries are shipped carefully crated and fully charged ready for use.

## "A" BATTERY RECTIFIERS

|   |       |
|---|-------|
| No. P-1 Tungar, 5 ampere type, complete with bulb | 28.00 |
| No. P-2 Tungar, 2 ampere type, complete with bulb | 18.00 |
| No. P-3 F. F. Battery Booster, 5 ampere type      | 15.00 |

## "B" BATTERIES

|  |      |
|--|------|
| No. 763 Eveready, 22.5 Volt, small size                        | 1.75 |
| No. 766 Eveready, 22.5 Volt, large size 16 1/4 to 22 1/4 Volts | 3.00 |
| No. 774 Eveready, 43 Volt, large size Variable                 | 5.00 |

## CRYSTAL RECEIVING SETS

|   |       |
|---|-------|
| Aeriola Jr., Westinghouse, complete with telephones | 25.00 |
| Everyman DeForest, complete with telephones         | 25.00 |

## CONDENSERS (Variable)

|  |      |
|--|------|
| No. 1 Chelsea fully mounted, .001 Mf.                      | 5.00 |
| No. 2 Chelsea fully mounted, .0005 Mf.                     | 4.50 |
| No. 3 Chelsea unmounted with dial .001 Mf.                 | 4.75 |
| No. 4 Chelsea unmounted with dial .0005 Mf.                | 4.25 |
| No. 367 Murdock fully mounted .001 Mf.                     | 4.50 |
| No. 368 Murdock fully mounted .0005 Mf.                    | 4.00 |
| No. 3660 Murdock unmounted without knob and dial .001 Mf.  | 4.00 |
| No. 3680 Murdock unmounted without knob and dial .0005 Mf. | 3.25 |

## TELEPHONES

|                                    |      |
|------------------------------------|------|
| No. 56 Murdock 2000 ohms           | 5.00 |
| No. 56 Murdock 3000 ohms           | 6.00 |
| No. 2A Stromberg Carlson 2000 ohms | 7.50 |
| No. P-1 Holtzer-Cabot 2200 ohms    | 8.00 |

Let "PITTSCO" fill your orders for any of the above items.  
Our SERVICE on these at the present time will please you!

**F. D. PITTS CO., INC.**  
12 PARK SQUARE, BOSTON, MASS.

Woolworth Bldg.,  
Providence, R. I.

3 Stores

276 Worthington St.  
Springfield, Mass.

# RADIO APPARATUS

LARGEST STOCK SOUTH  
PROMPT DELIVERIES

## SERVICE

|  |        |
|--|--------|
| B. Batteries Radiaco Small 22½ V.....        | \$1.50 |
| B. Batteries Radiaco large-tapped 22½ V....  | 2.65   |
| B. Batteries Eveready large-tapped 22½ V.... | 3.00   |
| Tubes UV200 Radiotron Detector.....          | 5.00   |
| Tubes UV201 Radiotron Amplifier.....         | 6.50   |
| Tubes UV202 Radiotron Trans-5 watt.....      | 8.00   |
| Tubes UV203 Radiotron Trans. 50 watt.....    | 30.00  |
| Tubes C300 Cunningham Detector.....          | 5.00   |
| Tubes C301 Cunningham Amplifier.....         | 6.50   |
| Tubes Electron Relay Detector.....           | 5.00   |
| Tubes A & P Amplifier.....                   | 6.50   |
| Phones Murdock 2000-ohm.....                 | 4.50   |
| Phones Murdock 3000-ohm.....                 | 5.50   |
| Phones Brandes Superior.....                 | 8.00   |
| Phones Brandes Navy.....                     | 14.00  |
| Phones Baldwin Type C.....                   | 12.00  |
| Phones Baldwin Type E.....                   | 13.00  |
| Phones Baldwin Type F.....                   | 14.00  |

## QUALITY

|                                   |        |
|-----------------------------------|--------|
| Sockets Paragon.....              | \$1.00 |
| Sockets Murdock.....              | 1.00   |
| Sockets G. A.....                 | 1.50   |
| Sockets DeForest.....             | 1.20   |
| Rheostats Paragon.....            | 1.50   |
| Rheostats DeForest.....           | 1.65   |
| Rheostats Gen. Radio.....         | 2.50   |
| Rheostats Remler-Jr.....          | 1.00   |
| Remler Rheostat.....              | 1.50   |
| Rheostats Parkin.....             | .75    |
| Corwin Dial & Knob 3".....        | 1.00   |
| Corwin Dial & Knob 3½".....       | 1.20   |
| Dial and Knob Chelsea.....        | 1.00   |
| Transformers, Acme Unmounted..... | 4.50   |
| Transformers, Acme Semi-mtd.....  | 5.00   |
| Transformers, Acme Mount:d.....   | 7.00   |
| Transformers, Federal.....        | 7.00   |
| Transformers, UV712.....          | 7.00   |

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

Acme Apparatus  
Clapp-Eastham  
DeForest  
Wm. Murdock

Federal  
Firth  
Radio Dist. Co.  
Radio Corp.

Brandes  
Adams-Morgan  
Chelsea  
Magnavox

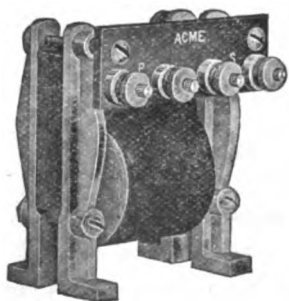
Remler  
Signal  
Eveready  
N. Baldwin Co.

## ROSE RADIO SUPPLY

604 GRAVIER STREET,

NEW ORLEANS, LA.

Send 10c for Catalog



**Amplify your signals  
with ACME Transformers**

Acme Transformers in your vacuum tube amplifier equipment, magnify voice and music as well as code without distortion and without howling. They are priced as low as specialized quantity production permits, with due regard for quality. At all Radio dealers.

**Acme Apparatus Co.**

194 Massachusetts Ave.,

Cambridge,

Mass.

Transformer and Radio Engineers and  
Manufacturers

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## RADIO CITIZENS

Complete stocks carried for immediate shipment of the following apparatus:

Grebe Murdock  
DeForest Adams-Morgan  
Acme Radio Corporation  
C. Brandes, Inc.  
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**FREE BULLETINS  
PRICE LISTS**

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

**Nash Electrical Service Co.**

Marshall, Ill.

# PARAGON

THE

## Pioneer

- 1915 First regenerative receiver ever manufactured bore the name PARAGON.
- 1916 First Trans-continental Amateur Reception (California from New York; not pre-arranged) effected with a PARAGON Type RA-6 Receiver.
- 1916 First Trans-continental Amateur Transmission (New York to California; not pre-arranged) effected by PARAGON designed transmitter.
- 1917-1918 PARAGON acknowledged supreme on Western Front.
- 1921 First Trans-Atlantic Amateur Reception effected with PARAGON receiving equipment, at which time 27 different amateurs scattered thruout the Eastern section of the United States registered signals at Ardrossan, Scotland—3500 miles.

*THERE'S A REASON!*

## The Adams-Morgan Company

*Manufacturers*

UPPER MONTCLAIR, N. J.

**A Symbol of  
Increasing  
Significance!**



**Westinghouse  
Aeriola-Sr.**

**\$65 POST PAID**

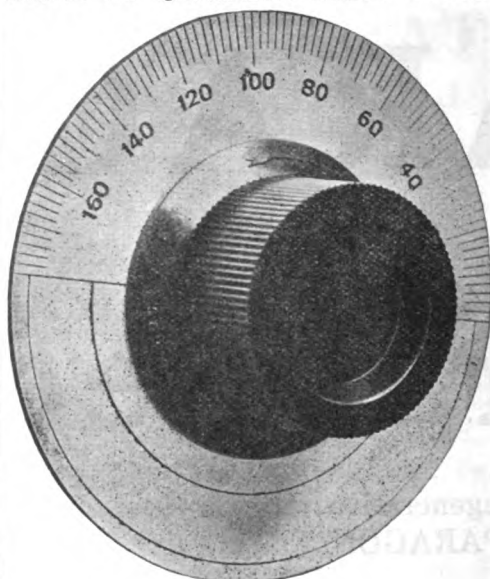
Complete with Brandes Headset and new Vacuum Tube—requiring but .2 amp. to heat filament and runs on a single \$6 Dry Cell (50c) and small "B" Battery (\$1.75).

**REGENERATIVE CIRCUIT**

Range 500 miles with average antenna and ground system.

**PROMPT SHIPMENT**

**Insist on SOMERVILLE DIAL INDICATORS**



**Cost More Than  
Imitations—But Are  
Worth the Difference.**

**PRICE**

**\$1.75**

For the 4" Dia. model and

**\$1.60**

for the new 3 1/4" dia. model

**POSTPAID**

from us, or from your dealer

New lot has dial insulated from shaft, so that dial may be grounded to act as a shield.

**SOMERVILLE RADIO LABORATORY**  
176-178 Washington St., Dept. QST  
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Send 25c for our **ENLARGED Catalog!**

**Why Pay More?  
SOMERVILLE  
100V. C.W.  
Condensers  
75c Postpaid**

## "NEWRAD"

**The Mark of satisfaction  
Immediate Shipment**

|                      |        |
|----------------------|--------|
| Variocouplers        | \$6.50 |
| Variometers          | 6.50   |
| V.T. Sockets         | .75    |
| Rheostats            | 1.50   |
| Amplifying Trans.    | 5.00   |
| Dials                | 1.10   |
| Phones—All Makes     |        |
| Magnavox             | 45.00  |
| Switch Points        | .03    |
| Switch Levers        | .65    |
| Plugs, Jacks—Federal |        |
| Binding Posts        | .12    |
| Insulators—All Types |        |
| Condensers           | 4.50   |

We handle all leading makes of equipment.

**The New York Radio Laboratories**

*Manufacturers, Jobbers, Dealers*

**ACKERMAN BLDG., BINGHAMTON, N. Y.**

## RADIO APPARATUS AND PARTS OF ALL MAKES FOR THE AMATEUR AND EXPERIMENTER

### PHONES

|                  |        |
|------------------|--------|
| Holtzer Cabot    | \$8.00 |
| Murdock 2000 ohm | 5.00   |
| Murdock 3000 ohm | 6.00   |
| Everett 3000 ohm | 8.50   |
| Federal 3200 ohm | 10.50  |

### JACKS

|                  |        |
|------------------|--------|
| Federal #1421-W  | \$0.70 |
| Federal #1422-W  | .85    |
| Federal #1423-W  | 1.00   |
| Filament Control |        |
| #1435            | 1.00   |

|                  |      |
|------------------|------|
| Filament Control |      |
| #1438            | 1.20 |
| Universal Plug   | 1.75 |

### CONDENSERS

|                  |        |
|------------------|--------|
| Coto-Coil Unmtd. |        |
| 15 Plates        | \$4.50 |
| Coto-Coil Mtd.   |        |
| 15 Plates        | 9.50   |
| Coto-Coil Unmtd. |        |
| 23 Plates        | 5.00   |
| Coto-Coil Mtd.   |        |
| 23 Plates        | 10.00  |
| Coto-Coil Unmtd. |        |
| 33 Plates        | 6.00   |
| Coto-Coil Mtd.   |        |
| 33 Plates        | 11.00  |
| Federal Unmtd.   |        |
| 23 Plates        | 3.25   |
| Federal Unmtd.   |        |
| 43 Plates        | 4.00   |
| Vernier 3 Plate  | 1.50   |

A complete line of General Radio Co., Coto-Coil, Amrad, W. J. Murdock, Acme Apparatus and Federal Tel. and Tel. Co. Apparatus.

**JAMES H. JONES**

**Radio Apparatus**

**94 Massachusetts Ave., Boston 17, Mass.**

### TRANSFORMERS

|                     |        |
|---------------------|--------|
| Coto-Coil Radio     |        |
| Frequency           | \$5.50 |
| Coto-Coil Audio     |        |
| Frequency           | 5.00   |
| General Radio Audio |        |
| Frequency           | 5.00   |
| Federal Audio       |        |
| Frequency           | 7.00   |
| Acme semi-mounted   | 5.00   |
| Acme mounted        | 7.00   |

### LOUD SPEAKERS

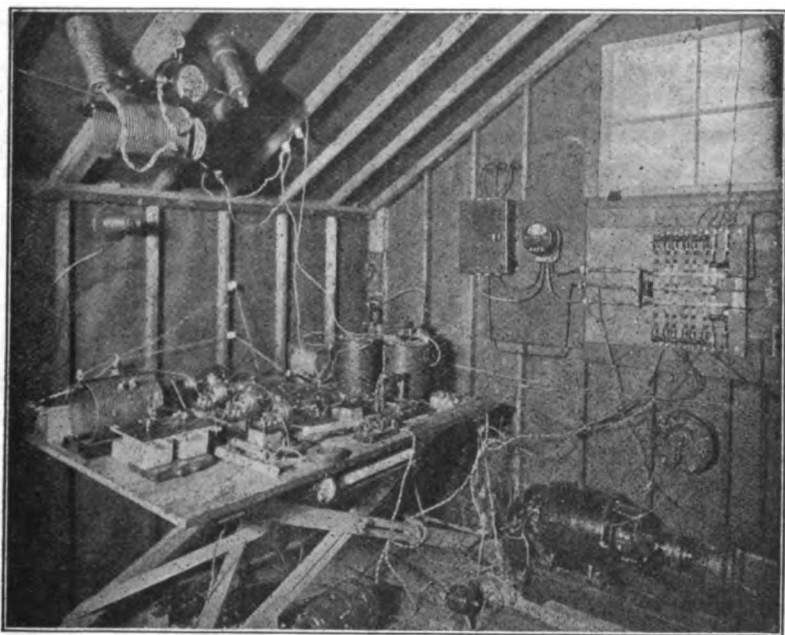
|                    |        |
|--------------------|--------|
| Arkay Horns        | \$5.00 |
| King Amplitone     | 12.00  |
| Pleophone          | 14.00  |
| Voclarion          | 6.50   |
| Magnavox           | 45.00  |
| Bristol Ampliphone | 40.00  |
| Western Electric   | 161.00 |

### RECEIVING SETS

|                     |         |
|---------------------|---------|
| Aeriola Jr. Crystal | \$25.00 |
| Westinghouse R A    | 68.00   |
| Westinghouse Det.   |         |
| 2 Stage             | 70.00   |
| Westinghouse        |         |
| R.C.                | 132.50  |
| Westinghouse        |         |
| Aeriola Grand       | 325.00  |

# Dubilier Condensers Helped to Make Radio History

"No circuit is stronger than its weakest link." When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



Are your condensers the weakest link in your circuit? There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

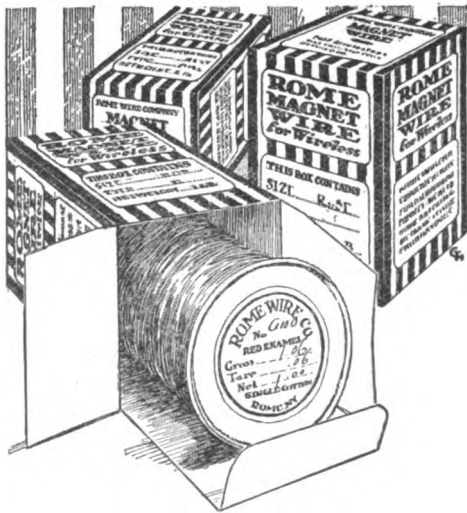
The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.

## **Pacent Electric Company, Inc.**

**150 Nassau Street,**

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**Member Radio Section Associated Manufacturers of Electrical Supplies.**



For satisfaction  
Demand Rome Blue  
and White Package  
or Label.

# ROME RADIO WIRE

## Magnet Wire

**Best Quality Plain Enamel Covered; Enamel—and Single or Double Cotton Covered; Single or Double Cotton Covered.**

**All Sizes; 1/4-lb to 40-lb. packages.**

## Antenna Wire

**Best Quality Solid or Stranded Copper Antenna Wire, plain or tinned; put up in lengths of 100-ft. and 150-ft. or on 24" reels of 200-lbs.**

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WIRE COMPANY.**  
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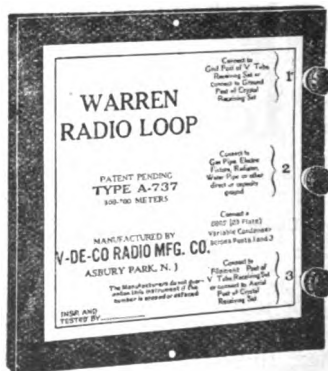
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2067-L

# Warren Radio Loop

NO  
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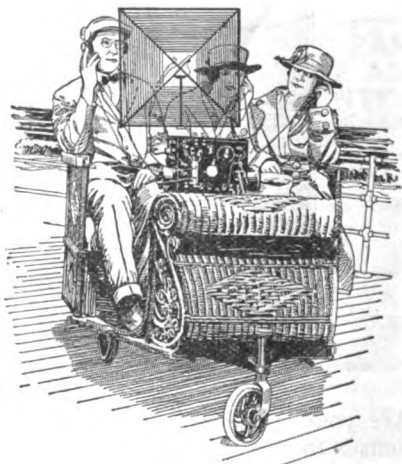
If Dad says—

**"NO AERIAL ON THIS HOUSE"**

don't allow his QRM to worry you but purchase a

## WARREN RADIO LOOP

The LOOP that made the Radio Roller Chair famous on the Boardwalk at Asbury Park, N. J. is just the thing for an apartment or den. Is light in weight and easily portable. Is produced under a new principle of winding. Is wholly enclosed, thereby protecting the winding. Is used in place of an outside aerial. Is adapted for receiving in moving vehicles. Takes the "tic" from static. Eliminates all danger from lightning. Can be used with any receiving instrument. Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on "Wireless Age" and "Radio News" and featured in many other magazine and newspapers in the United States.

Send your order through your dealer or direct to us with his name.

Type-A-737 (300-700 meters) . . . . . \$10.00

Type-A-7236 (175-1000 meters) . . . . . 12.00

**V-DE-CO RADIO MFG. CO.**

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. A101

# Enjoy the Great Radio Concerts No Matter Where You Live

## THOROPHONE

(THUNDERPHONE)

TRADE MARK REG. U.S. PAT. OFFICE

**Will Bring America's Popular  
Orchestras and Most Re-  
nowned Soloists Into  
Your Home**



**Model K400**  
Loud speaking receiver. Thorophone is attached to the bottom of the base and is concealed from view yet easily accessible.



**\$35.00  
Complete**

**Model 501**  
This beautiful instrument gives you the desired volume, and tone of exquisite quality and musical excellence.

Winkler-Reichmann Co., America's OLDEST manufacturer of Loud Speaking Telephones, offers the THOROPHONE for RADIO CONCERT WORK as its latest success.

In bringing out the THOROPHONE with Concert Horn—beauty and clarity of tone—ample volume—and mechanical perfection have been made outstanding features of design. Lay aside your head receivers—invite your friends in—enjoy with them a real musical treat. Use the THOROPHONE also for detecting and tuning.

The Thorophone requires better than the average radio receiving set to give a great, big powerful volume, but just give it the power and its musical qualities will astonish you.

THOSE DESIRING TO USE THEIR OWN PHONOGRAPHS CAN DO SO BY ATTACHING OUR ADAPTER WITH THOROPHONE DIRECT TO PHONOGRAPH TONE ARM.

### The Loud Speaking Receiver— THE THOROPHONE

Has a controlled mica diaphragm, and carefully designed sound box nickel plated throughout. Does not use up your storage battery. Simply connect it on in place of your head receivers.

#### THOROPHONE

**Model K400—\$20.00**

Phonograph adapter extra

**Model 350— .40**

### THE CONCERT HORN

Is a beautiful musical instrument, highly ornamental to any home. The base and tone arm are of mahogany finish wood, the neck of heavy metal and the bell of extra heavy spun aluminum. It has great brilliancy, WITHOUT METALLIC TONE.

#### CONCERT HORN

**Model H300—\$15.00**

**Height 25 inches.**

## WINKLER-REICHMANN CO.

**4801 South Morgan St.,**

**Chicago, Illinois**

**Dept. Q**

**DEALERS: We have a REAL loud speaker and a REAL proposition for you.**

# HOMCHARGE YOUR BATTERY *for A Nickel*

No fuss, trouble,  
dirt—no moving  
of batteries—loss  
of time—no ef-  
fort on your part  
—no technical or professional knowl-  
edge needed.



## THE HOMCHARGER

successfully meets all charging con-  
ditions, and is the only rectifier com-  
bining the following essential Hom-  
charging features.

1. Self polarizing. Connect battery either way and it will always charge. No danger of reverse charging, ruined battery or burnt out Rectifier.
2. No delicate bulbs to break or burn out. Only one moving and two wearing parts. These are replaceable as a unit, after thousands of hours use, at small cost. Cannot be injured by rough handling.
3. Operation stops and consump-  
tion of current ceases immediately upon disconnecting battery.
4. The only charger costing less than \$100.00 that will fully charge a bat-  
tery over night. Gives battery a taper charge—exactly as recommended by battery manufacturers. Guaranteed not to harm your battery even though left connected indefinitely.
5. Highest efficiency of any three or six cell charger made.
6. No danger of fire. Approved by the Underwriters.

### ATTENTION MOTORISTS

Will charge your auto battery as well as radio battery. Send for Bulletin No. 58 for further information.

For sale by all radio, electrical and accessory dealers or shipped express prepaid for purchase price.....\$18.50

\$20 West of the Rockies

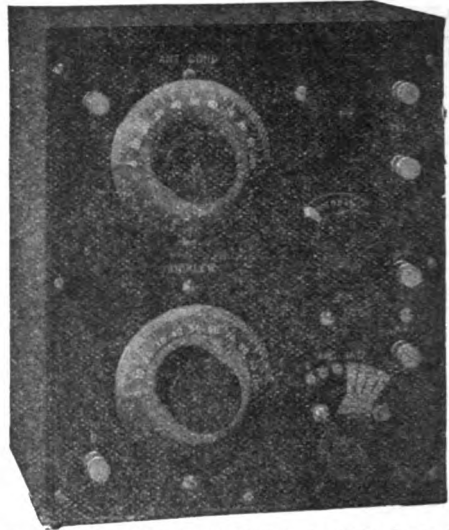
The Automatic Electrical Devices Co.

127 West Third St., Cincinnati, Ohio.

Branch offices: New York, Chicago, Pitts-  
burgh, Los Angeles, New Orleans, Detroit,  
Philadelphia, Baltimore, Dallas.



*Largest Manufacturers  
of Rectifiers in the World*



(Licensed under Armstrong U. S. patent No. 1,113,149)

## It Took 14 Years to Perfect This Set

**WE** have specialized exclusively in radio for more than fourteen years. Every one of those years has contributed something important to our latest Type H. R. Regenerative Receiving Set. We sincerely believe it to be the best set of this type on the market today—regardless of price.

Novices and experienced radio men alike praise its simplicity of operation, its sharp, clear tones, its wide range, its careful workmanship, its neat appearance. And invariably they express surprise at its unexpected performance. 6c stamps will bring you our new Radio Catalog—containing full information regarding this set and other radio equipment.

CLAPP-EASTHAM CO., 139 MAIN STREET  
CAMBRIDGE, MASS.

## Clapp - Eastham Type HR Regenerative Receiving Set

### SPECIFICATIONS:

CABINETS: Solid mahog-  
any, dull finish.

PANEL: Condensite, dull  
finish, machine en-  
graved white lettering.

DIALS: Indestructible  
metal, black with white  
lettering.

CONDENSER: Balanced  
type, built as a Vernier;

2 rotary, 3 stationary  
plates.

ANTENNA INDUCTANCE

Wound on formica tube.

PLATE INDUCTANCE:

Wound on molded ball.

BINDING PARTS: Black  
rubber covered.

SWITCH: Fan blade.

RHEOSTAT: Clapp-East-  
ham type H 400.

CIRCUIT: Single circuit  
regenerative.

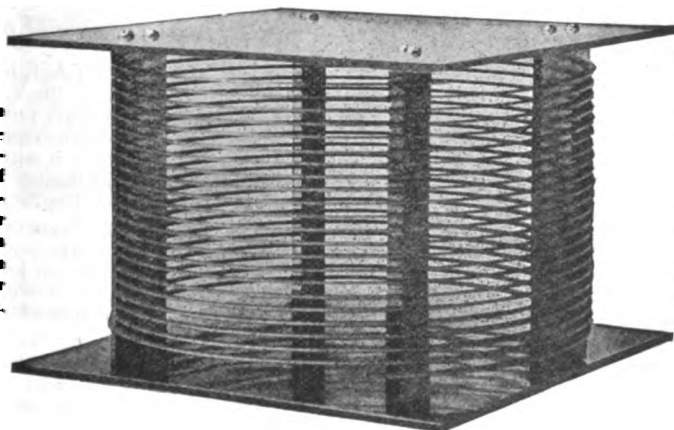
"B" BATTERY: Contain-  
ed in inside compart-  
ment or external, as  
desired.

PRICE: \$40.



# We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the WIMCO INDUCTANCE assures you of maximum results from your C.W. outfit. Its low resistance means greater antenna output.



Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size \$10.00. Grid Coil \$2.00 extra.

WIMCO C.W. 100 INDUCTANCE

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aeriols at 200 meters wave length;

| Wave Length | H. F. Resistance |
|-------------|------------------|
| 150         | .71 ohms         |
| 200         | .85 ohms         |
| 250         | .95 ohms         |

(effective inductance 80.5 microhenries at 200 meters)

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

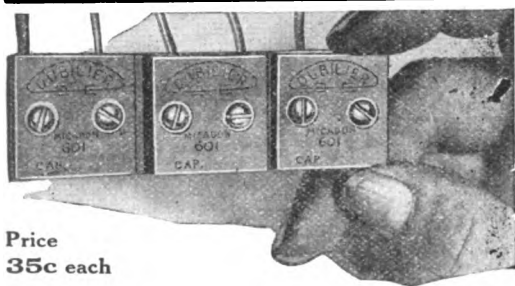
**ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER.** We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price \$5.00 fully mounted and thoroughly guaranteed. DEALERS—JOBBERs WRITE.

**REMLER APPARATUS—CUNNINGHAM TUBES—FROST REGENERATIVE RECEIVING SETS—CLAPP-EASTHAM AND FEDERAL PRODUCTS—HIPCO PLATE BATTERIES—WORKRITE VARIOMETERS AND COUPLERS—KLOSNER VERNIER RHEOSTATS—FADA APPARATUS—BRANDES AND BALDWIN HEADSETS**

## 8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

JOBBERs—MANUFACTURERS



## Better Reception With Micadons 601

Dubilier Micadon Type 601 is made like the famous larger, Dubilier mica condenser, which is the standard equipment of 95% of the governments and radio companies of the world.

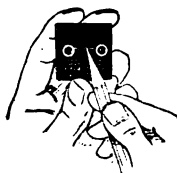
Dubilier Micadon Type 601 is a little larger than a postage stamp. Use Micadons Type 601 to build up any capacity by connecting them in series or parallel. Buy Micadons by the dozen and keep them on hand.

Dubilier Micadon Type 601 insures perfect broadcasting reception. Because the capacity is permanent, tube "howls" and noises are reduced.

Price 35 cents each for capacities .0001 to .0005 mfd; by the dozen \$4.00. Price 40 cents each for capacities .001, .002, and .0025 mfd; by the dozen \$4.50.

### MAKE YOUR OWN GRID-LEAK WITH A LEAD PENCIL

Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub the point of a black lead pencil over the roughened surface as here shown. To adjust the grid-leak thus made rub away as much of the graphite that has been deposited as may be necessary. Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.



*Order from your dealer*

### DUBILIER CONDENSER AND RADIO CORP.

Department Q. S., 217-219 Center St., New York  
Munsey Building, Washington, D. C.

#### LICENSEES:—

Canada: Canadian General Electric Co.,  
Toronto

England: Dubilier Condenser Co. Ltd. London  
Germany and South America: Telefunken Co.,  
Berlin

# MAGNAVOX Radio

*Everyone will  
envy you these  
evenings of pleasure*

**I**NCREASE to the utmost the enjoyment and use you now get from your receiving set -- equip it with a Magnavox Radio, (the perfected Reproducer.)

The Magnavox Radio does away with the restrictions of headsets—its clear, powerful tones are enjoyed by all.

With the Magnavox Radio the hookup is simple, and no extras or adjustments are required.

Without a Magnavox Radio no wireless receiving set is complete.



*Radio brings it,  
**MAGNAVOX**  
tells it*

*Any radio dealer will demonstrate for you, or write to us for descriptive booklet and name of nearest dealer.*

**The Magnavox Co.**  
Oakland, California  
N. Y. Office: 370 Seventh Ave.

# MURDOCK

## *radio necessities*

---



No. 56 Phones

**M**URDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$5.00 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

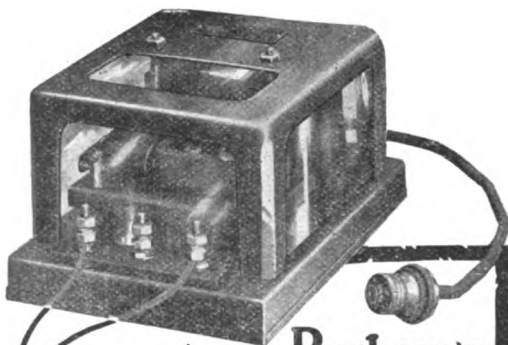
*Buy Murdock apparatus from your dealer.*

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# WM. J. MURDOCK Co.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

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## Recharge Your Battery at Home

### Charges both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a Valley Charger and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge it or harm it in any way.

Will charge the A 6 volt battery at a 5 ampere rate, and the B 22½ volt battery at the required ½ ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged.

### SATISFACTION GUARANTEED.

If your local distributor cannot supply you, write direct to

**VALLEY ELECTRIC COMPANY,**  
Department Q, ST. LOUIS, MO.

----- Mail the Coupon -----  
Valley Electric Co., Dept. Q, St. Louis, Mo.

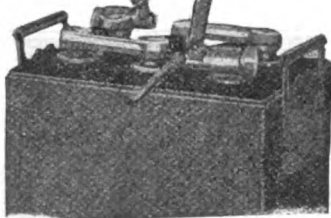
Gentlemen: I am enclosing money order (or check) for \$18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, I will return it and get my money.

\_\_\_\_\_  
Name

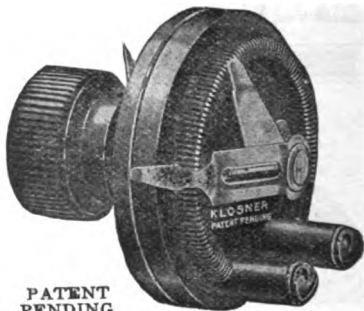
\_\_\_\_\_  
Address

**\$18.00**

F.O.B. St. Louis



## MAKE NO MISTAKE THE KLOSNER VERNIER RHEOSTAT



PATENT  
PENDING

is the only Vernier Rheostat made having the exclusive feature of using but

### ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name KLOSNER moulded on the base.

Your dealer has them or send direct to us.

**PRICE \$1.50**

Shipping weight, One pound.

A two cent stamp brings interesting literature.

Made only by the Originators.

## The Klosner Improved Apparatus Company

Dept. Q4

2024 Boston Road, New York City  
N. Y.

# A - P

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## **Atlantic-Pacific Radio Supplies Co.**

**638 MISSION ST.**

**SAN FRANCISCO, CALIFORNIA**

**EASTERN OFFICE, 5 KIRK PLACE**

**NEWARK, NEW JERSEY**

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## **Radio Engineers**

**CONSULTING - DESIGNING  
CONSTRUCTION**

# R RIGGS R ECTIFIE R



\$12.50

P.P. Anywhere in the U. S.

**Cheapest, Best and Most Efficient on the Market. Only One Adjustment.**

We guarantee the Type B to please you. Not only to do all we claim for it, but to please you. If you don't like it, we will take it back and return your money.

**THE RIGGS MFG. CO.**  
URBANA, OHIO  
Everett Wash., Hamilton, Ont. Canada.  
DEALERS WRITE

# RTS

## Equipment Specialties RTS Switch Lever

The attention of jobbers and dealers is especially called to the RTS Bushing Lever made to retail at 60 cents. It has many improved features. The knob is of the well known Marconi type, 1 3/4 inches in diameter. The spring lever of nickel bronze has ground ends, insuring smooth and positive adjustment. It has a 3/8 inch bushing and lock nut for panel assembly. A guide bushing under the knob is an important feature as it raises the lever to the proper height for all switch points.



### Announcing the New

#### R T S Grid Condenser

The new RTS Grid Condenser is now ready for delivery. Contains many improvements not found in other types. Capacity .0005 M.F., price to retail at only.....30c

#### R T S Phone Condenser

R T S Condensers need little description. Their accuracy and simplicity have made them universally popular. The RTS phone condensers, capacity .0013 M.F. complete with binding posts ready for connection, to retail at.....35c each

#### R T S Aerial Wire

A new shipment of Lake Superior solid copper #14 aerial wire—a bargain at.....60c per 100 ft.

#### R T S Rubber Binding Posts

These posts are as good as any you can find. Bushing heavily nickel plated. Give the amateur's instruments the appearance of a first class outfit. 12c each or.....\$1.25 per dozen

#### Discounts to Dealers

Dealers and jobbers—Write us today for special quotations and discounts on all R T S equipment.

## RADIO TESTING STATION

Dept. Q-6, 25 Sturgis St.  
Binghamton, New York

Head  
Receivers  
Micro-  
Phones



Keys  
Jacks  
Plugs  
Etc.

HIGH GRADE  
WIRELESS APPARATUS  
Manufactured by

*American Electric*  
COMPANY

State and 64th Sts., Chicago, U.S.A.

Agents for the

## DX RADIO FREQUENCY TRANSFORMER



The secret of DX work. Makes coil aerial reception a reality. Its superiority is well established. Prove it for yourself. See p. 930, April-May, 1922 issue Radio News.

Range 170- 450 meters \$8.00  
Range 400-1200 meters \$8.00  
Range 900-3000 meters \$8.00  
COLUMBIA RADIO SUPPLY CO.  
808 19th St. N. W. Plug-in socket mounting \$1  
Washington, D. C.

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# Get the best results from your Radio outfit with the famous DICTOGRAPH HEADSET

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Here is the headset that gives you clear distinct tones that reproduces perfectly the most sensitive radio signals. Try it at your dealer's. Be sure its the Dictograph Headset.

---



Type  
R-1

3000  
Ohms

Price  
\$12



**D**ICTOGRAPH has always stood for the most accurate and sensitive sound transmission. The Dictograph Products Corporation has for many years taken an active part in the development of radio transmitting and receiving units.

All Dictograph radio headsets are made, complete, in the famous Dictograph factories, using the same materials and workmanship that have made the Detective Dictograph, the Acousticon for the Deaf, and the Dictograph System of Telephones the standard of the world for sensitive receiving and loud speaking.

No other headset is like the Dictograph. You will be amazed at the clearness, the accuracy and the delicacy of its sound transmission. The headset is one of the most important parts of your outfit and unless it is made by experts of long experience in the making of the most sensitive instruments, you cannot get the best results from your radio outfit no matter how good it is.

Ask for the Dictograph Headset at your dealer's. Examine it, try it. Be sure it is a Dictograph.

## DICTOGRAPH PRODUCTS CORPORATION

Charles H. Lehman, President

220 West 42nd Street,

New York City

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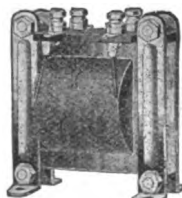
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# JEFFERSON

## Amplifying Transformers



No. 45



No. 41

Secure maximum amplification by using Transformers designed especially for the new audiotron and Radiotron Tubes.

Jefferson Transformers are the result of exhaustive tests of every kind, and are positively unequalled for audibility and amplifying power.

Our No. 45 Navy Type is the most widely used transformer in the country. If you are not getting maximum amplification try it and note the improvement, the absence of distortion and the clearness of tone.

The No. 41 Transformer is also a very popular type. It is wound with No. 40 wire while the No. 45 is wound with No. 44 wire. Otherwise the construction is identical. The highest grade 36 gauge Silicon Steel is used for the core. The Primary Resistance of the No. 41 is approximately 900 ohms, of the No. 45 approximately 1800 ohms. Secondary Resistance: No. 41, approximately 5000 ohms, No. 45 approximately 8500 ohms.

Transformers are mounted in attractive brass frames with genuine Bakelite panels which carry the primary and secondary terminals. These Transformers are also furnished unmounted.

*Send for Radio Bulletin*

## Jefferson Electric Mfg. Co.

425 S. GREEN ST., CHICAGO, ILL.



**FOR SALE—COMPLETE 150-25,000 meter RECEIVER and 100 WATT TRANSMITTER.** Guaranteed as good as new, with brand new receiving and transmitting tubes. Cost \$820.00 to build. First certified check, draft, or money order for \$385.00 takes it.

### Receiver

Complete variometer or honeycomb tuner with throwover switch. Radiotron detector and 2 step amplifier. 120 hr. storage battery. 120 volt "B" battery. Brown imported phones. Excellent for DX work or music reception.

### Transmitter

2 new 50 watt tubes. Radio Corporation instruments used. Can be converted into phone set by addition of motor generator or Kenotron rectifiers. Automatic antenna control. Wave change switch.

### Cabinet

Fumed oak case and pedestal. Front completely encloses set. Storage battery compartment.

### Reason for selling

Putting in DeForest 1 K.W. Oscillon Set

Wire or Write R. Karlows, 313 E. 29th St. Davenport, Iowa

## Radio Telephony For Amateurs

### by STUART BALLANTINE

*Formerly Expert Radio Aid U.S.N.*

is the book that tells the how and why of radio telephony. Written so you can understand it fully. The biggest help to the amateur operator. 200 pages, fully illustrated.

**\$1.50 net, by mail \$1.65**

Send for your copy

**DAVID McKAY COMPANY**  
Philadelphia

## Send Us Your Orders For

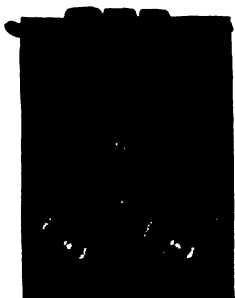
Variable Condensers, Variometers, Variocouplers, Loose Couplers, Tuning Coils, Amplifying Transformers, Sliders, Switches, Switch Points, Binding Posts, etc.

We are large manufacturers. Gorton machine engraving or manufacturing special parts to order.

**F. JOS. LAMB COMPANY**  
1938 Franklin St., Detroit, Michigan



# Type "Q" Receiver

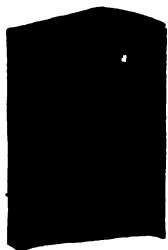


## AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....\$35.00

## Duck's New Radio Catalog No. 16



Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.

### 275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

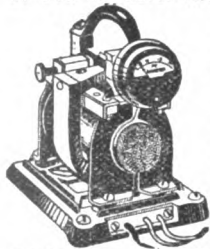
## The William B. Duck Company

243-245 Superior Street

Toledo, Ohio

## 10c. Charges Radio & Auto Batteries <sup>AT HOME</sup> WITH AN F-F Booster

So You will never have to give up, in disgust when



working a distant station  
Is it not gratifying to feel  
Your Batteries will never fail  
& are always ready to LISTEN  
IN & receive all RADIOPHONE  
BROADCAST, Music, Sermons,  
& News, never having to tell  
Friends Your Batteries are dead.  
The AMMETER shows You the  
amount of Current Flowing.  
Both Waves of Current are  
rectified thru adjustable  
& easily renewable Carbon  
Electrodes, which maintain  
a constant efficiency & last

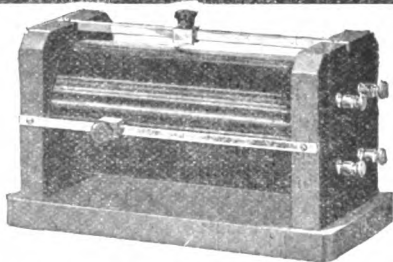
indefinitely.. Each F-F Battery Booster Type is in  
itself a Complete Compact Self-Contained & Portable  
Magnetic Rectifier & Charging Unit, for 105-125 Volt 60  
Cycle A.C. which Operates Automatically & Unattended.  
Screw Plug In Lamp Socket, Snap Clip-on Battery Termi-  
nals & watch the Gravity come up. PRE-WAR PRICES  
Bantam Type 6 Charges A 6 Volt Battery At 6 amperes \$15  
Type B Charges "B" Batteries up to 100 Volts \$15  
Radio Type A-B Charges Both Your "A & B" Batteries \$20  
Bantam Type 12 Charges 12 Volt Battery At 5 Amperes \$15  
Type 166 Charges 6 Volt Battery At 12 Amperes \$24  
Type 1612 Charges 12 Volt Battery At 7 Amperes \$24  
Type 1626 is a Combination of Type 166 & 1612 \$36  
The Large Types are for heavy Batteries, or Where Time is  
Limited. Shipping Weights Complete 1 to 15 Pounds.  
Order from Dealer or send check for Prompt Express  
Shipment. If via Parcel Post have remittance include  
Postage & Insurance Charges. Or have us ship C.O.D.  
Other F-F Battery Boosters charge Batteries from  
Farm Lighting Plants & D.C. Circuits & for GROUP  
CHARGING use our 12 Battery, 8 Ampere Capacity  
\$135. Full Wave Automatic ROTARY Rectifier in FREE Bulletin No. 31  
Order Now or Write Immediately for Free BOOSTER Bulletin No. 31

**The France Mfg. Co.** OFFICES & WORKS  
CLEVELAND, OHIO, U.S.A.  
Canadian Representative: Battery Service & Sales Co. Hamilton, Ontario, Can.

## JOY-KELSEY CORPORATION

Manufacturers of  
**RADIO EQUIPMENT**

**4021 Kinzie Street**  
**Chicago, Illinois**



**LAMB TUNING COILS.** Two Nickel sliders and  
rods; four nickel binding posts. Coil contains  
about 1/2 lb 222 enameled magnet wire. Mounted  
in hard wood ends and base. Price \$3.00.  
1/4" Sliders—Brass 20c; Nickel 25c.  
1/4" Slider Rods—Brass 15c; Nickel 20c.  
Crystal Detectors, nickel plated on Mahogany  
Base, \$1.00.  
Crystal Detectors, glass case and fibre base,  
\$1.25.

Contact Points, threaded with nuts—20c dozen.  
Compo. cap, Nickel base Binding Posts—7c each.  
Plain Nickel Binding Posts—3 1/2c each.

**IMMEDIATE DELIVERIES**  
Liberal discounts to dealers

**F. JOS. LAMB COMPANY,**  
1938 Franklin St., Detroit, Mich.

## Wireless Amateurs Attention!

If you want service, order from us.  
We carry a large stock of High Grade  
Wireless Apparatus of our own and  
other manufacturers.

### SPECIAL!

|                                 |        |
|---------------------------------|--------|
| Vacuum Tube Sockets.....        | \$1.25 |
| Rheostats .....                 | 1.25   |
| 22 1/2 Volt "B" Batteries.....  | 1.50   |
| Rasco Dials .....               | .60    |
| Rubber Binding Posts .....      | .20    |
| Tested Galena .....             | .40    |
| Lateral Wound Coils. All Sizes. |        |

SEND 5c FOR OUR NEW PRICE LIST

**J. M. PAQUIN,**  
THE ELECTRICAL SHOP  
787 Queen St. West, Toronto, Ont.

## RAY-DI-CO

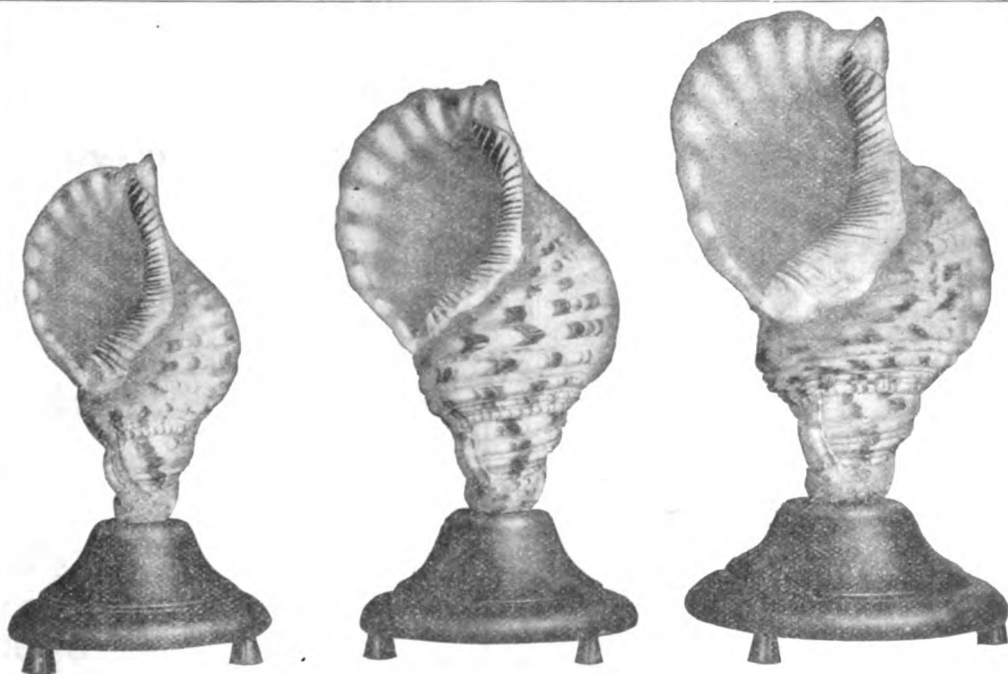
Radio Supplies for Service and Satisfaction  
Write, wire or phone us for prices and information

**RAY-DI-CO Organization**

1547D N. WELLS ST., CHICAGO, ILL.

We will purchase for cash, ideas or in-  
ventions in connection with Radiophone  
Reception. Write giving name, address and  
telephone number.

**ADDRESS "IDEAS"**  
c/o QST, Hartford, Conn.



## SEA HORN LOUD SPEAKERS

### NATURE'S PERFECT AMPLIFIER

### THE BEST AMPLIFYING HORN OFFERED

### SPLENDID DEFINITION

Artistic and Ornamental Genuine Sea Shells mounted on rich mahogany finished bases complete with phone clamp. 12 to 13 inches high \$8.00; 13½ to 14½ inches high \$12.00; 15 to 16½ inches high \$15.00.

 **FOR IMMEDIATE DELIVERY AND MONEY BACK IF YOU ARE NOT SATISFIED. ORDERS FILLED IN ROTATION AS RECEIVED.**



#### Precision Condensers Without Dials

|               |        |
|---------------|--------|
| 43 Plate..... | \$4.00 |
| 23 Plate..... | 3.50   |
| 11 Plate..... | 3.25   |
| 3" Dials..... | .85    |

#### Vacuum Tube Sock- ets Unbreakable.. 1.00

May be used for either panel or base mounting.

Phone clamps for Victor and Columbia phonographs enable you to use the horn on tone chamber of phonograph for a Loud Speaker \$1.50.

The above articles are ready for immediate shipment with the understanding that money will be refunded if goods are not satisfactory.

## THE ORO-TONE CO.

Mfr's of Phonograph and Wireless Equipment  
DEALERS SEND FOR SPECIAL FOLDER

1000 to 1010 George St.,

Chicago, Ills.

# Hygrade Specials

SAVE YOU MONEY

|   |        |
|---|--------|
| No. 766 Eveready 22½ volt large Variable B. Battery and Eveready Volt Meter | \$3.00 |
| 45 volt Cyclone large Variable B. Battery                                   | 2.75   |
| Binding Posts (rubber cap), per dozen                                       | .75    |
| Electrode Insulators, per dozen   | 2.00   |
| 3-inch Bakelite Dials   | .75    |
| 7-Stranded Copper Aerial Wire, 100 ft.                                      | .65    |
| Arkay Loud Speaker  | 4.00   |
| Bakelite V. T. Sockets  | .65    |
| Fada Rheostats  | .90    |
| Klosner Vernier Rheostats   | 1.25   |
| .001 M.F. Signal Variable Condenser with Dial                               | 4.50   |
| Thordarson Amplifying Transformers  | 3.98   |
| Everett 3000 Ohm Head Set   | 6.95   |
| Dietograph 3000 Ohm Head Set  | 9.95   |
| Federal 2200 Ohm Head Set   | 7.25   |
| Western Electric Head Set (Navy Type)                                       | 13.50  |
| Homcharger—Rectifier  | 16.75  |

## MARKO STORAGE BATTERIES

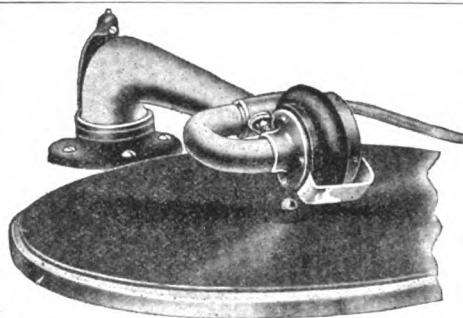
|                                      |         |
|--------------------------------------|---------|
| 6 volt, 30 amp., guaranteed 2 years  | \$10.00 |
| 6 volt, 60 amp., guaranteed 2 years  | 13.50   |
| 6 volt, 80 amp., guaranteed 2 years  | 17.00   |
| 6 volt, 100 amp., guaranteed 2 years | 21.00   |

We do not charge for crating. Above batteries are fully charged when shipped.

Above prices are F. O. B. New York

**Hygrade Electrical Novelty Co.**  
41 West 125th Street

Dept. S. NEW YORK



## USE YOUR PHONOGRAPH FOR A LOUD SPEAKER

No. 51 PHONE CLAMP.....\$1.50

Attaches phone to Edison, Victor and Columbia talking machines. Also made to fit Oro-Tone tone arm. Makes tone chamber of your phonograph a loud speaker, state make of phonograph.

DEALERS SEND FOR SAMPLE AND CATALOG  
**THE ORO-TONE CO.**

1010 GEORGE ST., CHICAGO, ILL.

# Prepared Radio Measurements

with  
Self Computing Charts  
by *Ralph R. Batcher*

A new WIRELESS PRESS book. Published as a real help to amateur radio. Obviates the necessity of long and involved mathematical calculations. A ruler or transparent triangle takes the place of intricate figuring and the results will be correct every time.

PRICE \$2.00

## The WIRELESS AGE

*The magazine that meets  
all your expectations.*

When its new you find it in the AGE. Every step in radio progress is fully and carefully described. You miss a lot of good things unless you read the AGE. \$2.50 per year, Postage outside U. S. 50c.

## SPECIAL OFFER ONLY

Prepared  
Radio  
Measurements

&

The  
Wireless  
Age  
1 Year

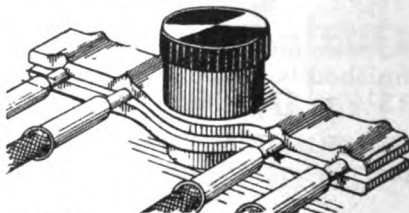
\$4.00

Outside U. S.  
50c. Extra

**WIRELESS PRESS, INC.**

328 Broadway,

New York



## FOUR SETS OF PHONES!

**25c** will buy a set of Multiple Binding Post Connections (patent pending) which provide the only practical means of attaching as many as 4 pairs of telephone receivers to a pair of ordinary binding posts.

Dual connection set provides same connection in attaching Magnavox and outfit to storage battery.

Either set will be sent postpaid upon receipt of 25c in coin or stamps. Satisfaction guaranteed or money back.

**Portable Wireless Telephone Co.**

Dep't B, Commercial Bank Bldg.,  
**STOCKTON, CALIFORNIA**

Attractive Dealer's Proposition.

## CRYSTAL RADIO SET \$4.75

Complete in Cabinet as shown. With Telephone and Antenna \$10.00. Satisfaction guaranteed or Money Refunded.

**CORONA RADIO CORP.**  
265 Canal St., N. Y.

# CABINETS

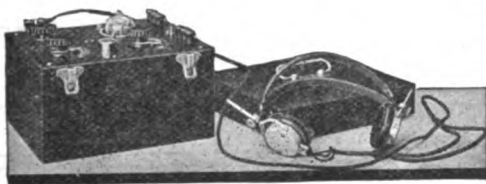
We build Cabinets for any size panel in any finish. Will quote on one or a thousand. Please send specifications.

**NATIONAL CABINET CO.**  
DAYTON, OHIO



## To Receive Broadcasting Radiophones

### The Radiohome Receiver

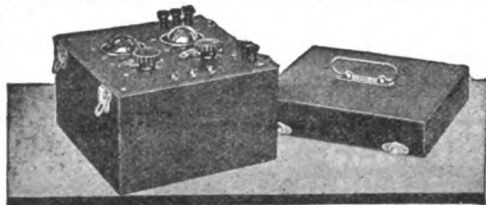


The Radiohome Receiver

### The DT-800 Amplifier

Every amateur is frequently being asked for advice as to what set should be purchased for the reception of radio telephone programs of music, news and stories. Many an amateur hesitates to recommend standard amateur equipment as his friends would be confused and bewildered by the array of controls on such a set.

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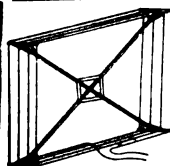
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Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 10th of month for succeeding month's issue.

**FOR SALE:** 1KW spark transformer in good condition \$20. ICBC Harold M. Baker, 85 West St., Reading, Mass.

**TRIPLE GEAR** honeycomb coil regenerative receiver including coils and Radiotron Detector \$80.00. Box 206, Williamsport, Pa.

**SELL:** 1KW Type R Thordarson twenty five dollars; Oil Immersed Condenser fifteen dollars; Thordarson Rotary Gap five dollars; C.W. set two 5 watt capacity — (the original first prize set—see Sept. QST, page 25), sixty dollars. Will exchange for 50 watt set. 419 Cottage Ave., Glen Ellyn, Ill.

**STOP!** Look at these prices! Atlas amplifying transformers, \$3.50; Atlas sockets, \$0.85; Atlas rheostats, \$0.85; Luma closed circuit jacks, \$0.90; Our own make apparatus below employs the above equipment. Detector and two stage amplifier, \$35.00; Two stage amplifier, \$30.00; Detector and one stage amplifier, \$20.00; One stage amplifier, \$15.00; Detector, \$5.00; These amplifiers are on formica panels. Send for price list of other apparatus. We give twelve hour service. Loh's Radio Shop, 1004 E. Indiana St., Evansville, Ind.

**MR. AMATEUR, MR. PROFESSIONAL, QST EVERYMAN INTERESTED IN RADIO:** That radio concert! That music! That speech! you received via the Radiophone! You hear it once and it's gone forever! Wouldn't you like to make a permanent record of it? Your own amplifier can make it! Your own amplifier can reproduce it! Any time, any number of times! No change of circuit,—no extra wiring. No sound methods requiring High Amplification. Direct recording of speech, music, voice, code! Listen to the "traffic." Record what you wish. Then at will, reproduce it exactly in same tones as original! The one thing needed to make your radio complete. You build it yourself. Three dollars for complete literature and clear set of building plans. Enclose the three with your name and address to Radio Mail Club, New Bedford, Massachusetts. "Don't let that music get by."

**A FEW MORE Bargains in Edison Batteries:** 6.5 volt 225 ampere hours, \$29.00; 10.5 volt, \$44.00; Single cells 1.3 volts 225 ampere hours for \$5.50 each F. O. B. New York City. Edison elements for B Batteries, 6c per set. A. J. Hanks, 606 Montgomery St. Jersey City, N. J.

**RADIO STORAGE BATTERIES** at lowest prices. Send for price list. Lloyd E. Clark, 383 Broadway, Everett, Mass.

**FOR SALE QUICK,** Magnavox, never used, \$40.00; Paragon 6 regenerator complete with bulb \$40.00; Universal Arc Receiver \$30.00; Portable Tungar charger \$20.00; 1 K.W. Thordarson, type R, \$30.00; 25000 volt Dubilier Condenser \$35.00; Hyrad Rotary \$20; switch-board, meters, keys, wavemeters, all like new. E. H. Hartnell, Salem, Wis.

**WANTED:** Phones, charger, amplifier parts, battery, large insulators, changeover, etc. What have you? Orville Huiish, 140 Byron St., Youngstown, Ohio.

**SPECIAL:** Formica panels, 6x12, \$1.00; 6x21, \$1.75; Mahogany finished cabinets, to fit, respectively \$3.25 and \$4.25. Immediate delivery on Radiotron and A.P. tubes, Holtzer-Cabot phones, \$8.00, Stromberg-Carlson, \$7.50, No. 56 Murdock's \$5.00. We handle all kinds of apparatus and supplies. Get our prices on sets. Home Radio Company, 140 Liberty St., Bowling Green, O.

**THE STANDARD Radio Log and Record**—A continuous diary and record of all station activities. Provision for recording calls received and sent with location, distance, wave length and other information. Sections for keeping records of calls frequently used, station data, license numbers, equipment inventory, Notable performances, etc. Flexible binding, 48 pages and cover. Price 30c prepaid or from your dealer. Metcalfe Publishing Company, 56 Harrison Ave., Springfield, Mass.

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**WANTED:** QST, March, June, August 1916 and "Midget"—"Everyday Engineering," Vol. 1, Nos. 1 and 2—"Pacific Radio News," June, 1921.—W. A. Mason, Avon Lake, O.

**QRA? 4DC**—Not Atlanta but William Boyett, Greensboro, N. C.—Please correct your call book O.M.

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**SACRIFICE** ½ Kilowatt Thordarson, \$10; also violin. Write. Russell Martin, Mt. Carmel, Ill.

**THIS MONTH'S SPECIAL:** Complete aerial outfit—100 feet hard drawn copper wire—50 feet rubber covered wire—four 4" antenna insulators—1 lightning switch—1 porcelain tube—1 ground clamp—\$2.50 complete postpaid—Remit postal or express money order to M. J. Winkler, 220 West 42 Street, New York.

**FOR SALE:** Grebe CR-3 and Grebe RORD detector and two step, complete with Radiotron tubes, latest model with vernier controls, one pair Baldwin phones, "B" batteries and 6 volt 60 ampere storage battery, 100 ampere ground switch, 43 plate variable condenser, General Radio Hot wire ammeter mounted, lead in insulator. Everything listed is brand new and in perfect condition. Price \$125.00. W. M. Bruce, c/o Morrilton Cotton Oil Co., Morrilton, Ark.

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**NOISELESS**—That describes Burgess "B" Batteries. Large stock. Immediate shipment. The Practical Supply Co., Binghamton, N. Y.

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**ANTENNA WIRE** 7 strand 22 tinned copper \$0.65 per 100 ft; DeForest Home sets each, \$30.50; Westinghouse set, \$120.00 or will swap one of them for Grebe; have 5 in stock. Also Clapp-Eastham, Acme, Western Electric and others. Henry Kulikowski, Ansonia, Conn.

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**FOR SALE:** Single tuned Regenerative, detector and one step amp. \$42.00 complete in cabinet less bulbs. 2 step amplifier in cabinet \$28.00. Photo on above sets on request. Arthur Walsor, Chesaning, Mich.

**C.W.—R.C.** Power transformer No. UP-1016 and 2 UV-217 Kenotrons with sockets, used only 30 hours. Price \$75.00. Radio 9WQ, Carthage, Ill.

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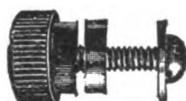
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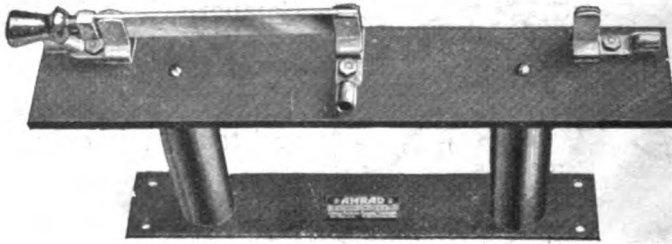
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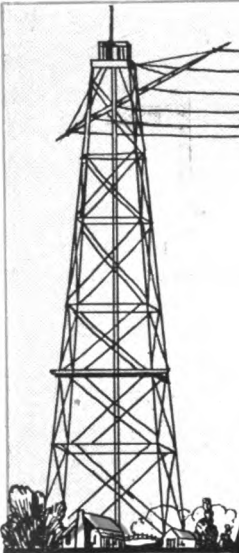


Vol 5

# QST

Devoted Exclusively to  
**CITIZEN RADIO**  
Published by the  
**AMERICAN RADIO RELAY LEAGUE**





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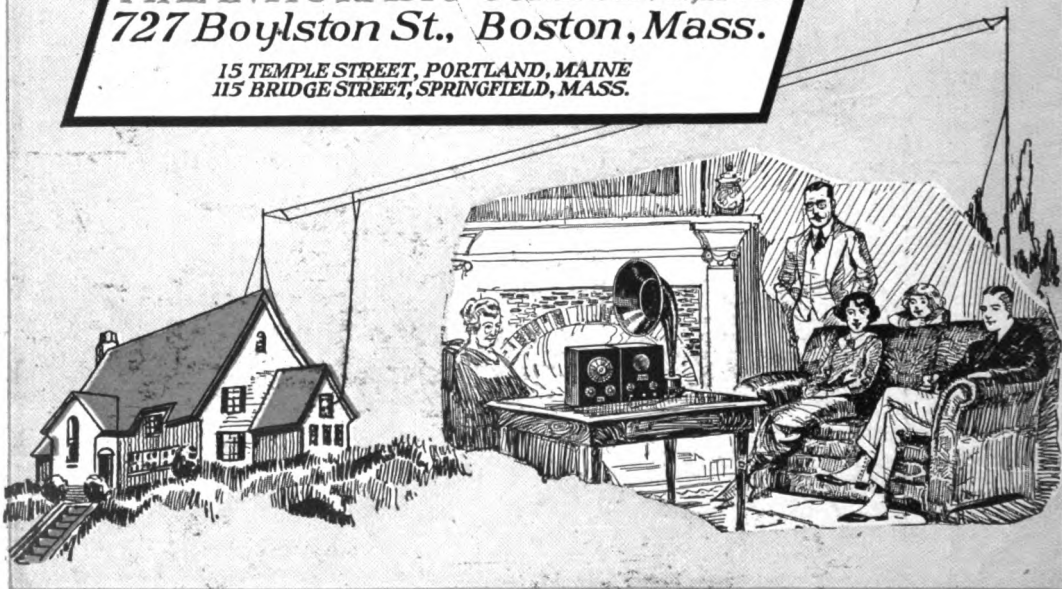
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The Radio Corporation's "C.W." manual and catalog 25c. per copy.

**ATLANTIC RADIO COMPANY, INC.**  
**727 Boylston St., Boston, Mass.**

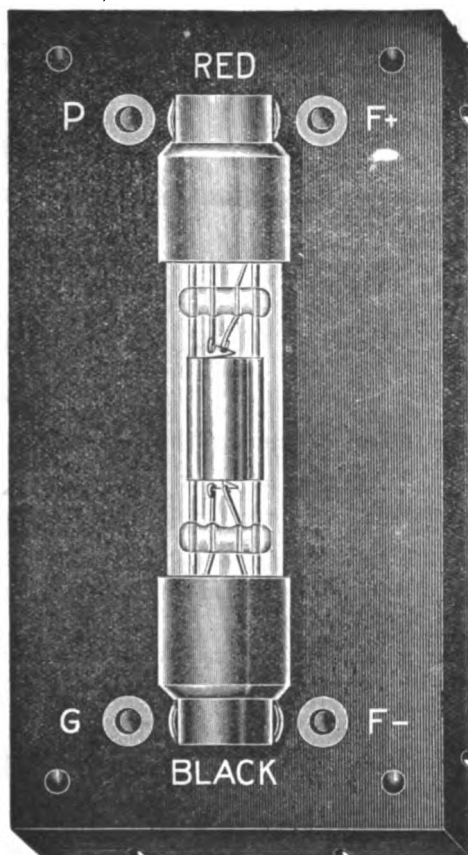
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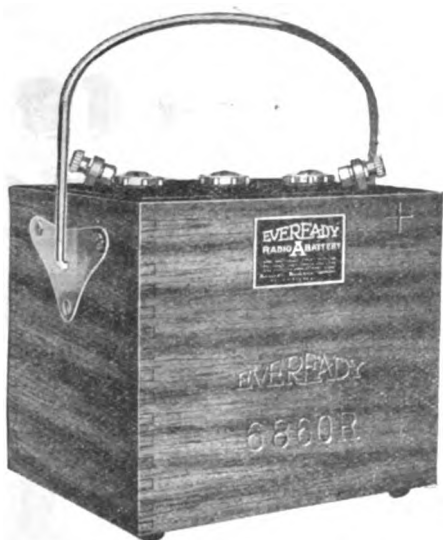
The latter class is likely to be an infringer of patents, an imitator of trade names. He substitutes "just as good" for the buyer's specification. His favorite motto is "the Radio public will buy anything". That is what they sell "anything" regardless of its quality.

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Condensite is a standardized product of known composition, guaranteed by a firm that is a recognized authority on the art of molded insulation.

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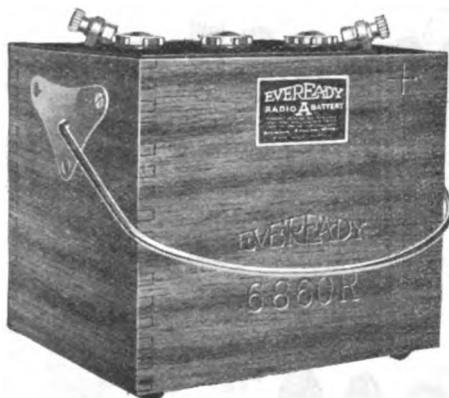


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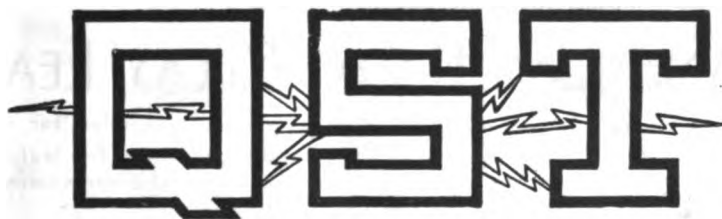
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# The Official Organ of the A.R.R.L.

VOLUME V.

JULY, 1922

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THE AMERICAN RADIO RELAY LEAGUE, Inc.  
HARTFORD, CONN.

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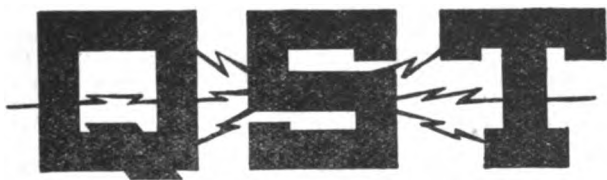
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A Magazine Devoted Exclusively to the Radio Amateur

## ***Super-Regeneration***

***An Invention of Tremendous Importance to the Amateur***

***By K. B. Warner***

**B**EFORE the biggest audience ever gathered at a meeting of the Institute of Radio Engineers, Edwin Howard Armstrong on June 7th gave his new invention of super-regeneration to a tense and expectant audience in the form of a paper entitled "Some Recent Developments of Regenerative Circuits". In presenting Mr. Armstrong, Fulton Cutting, president of the Institute, stated that the new discovery completely overshadowed regeneration as we now know it and opened a new chapter of radio frequency amplification.

Indeed it seems to do all of that. For super-regeneration is the thing about which so many wild rumors were floating around—the method that makes two tubes do all the work that ten used to do in the super-heterodyne, the plan that with two tubes gives telegraph signals a million times as strong as with an ordinary regenerative detector and phone signals a hundred thousand times as strong or thereabouts. The methods are astonishingly simple and we expect that they will cause a complete revolution in the amplification practices of the advanced amateur. Offhand, they would seem to solve forever problems of short-wave radio amplification, and even to make junk of the super-heterodynes, than which up to this time....etc.! Mr. Armstrong will deliver a paper on his new principles before a special meeting of the Radio Club of America in late June—a paper for the practical amateur, complete with constants, number of turns of wire, etc.—and that paper will be printed in QST, but unfortunately it could not be prepared in time for this issue. The following impressions, then, are gleaned from his I.R.E. paper and the diagrams are reproduced therefrom with the kind permission of Dr. A. N. Goldsmith, I.R.E. secretary.

As we all know from experience, oscillation represents the theoretical limit of amplification in our present-day receivers. How often, in approaching critical regeneration and hearing the signals build up enormously, have we wished that it might be possible to advance the regeneration just a little more, even one degree on the scale, without the bulb flopping into oscillation! The increase in amplification just below the oscillating point is amazing, and if only it could be squeezed a wee bit more how wonderful it would be! That is exactly what Armstrong's new scheme does—it extends the range of regeneration without oscillation, by means of a trick. We say a trick, because the oscillating point is theoretically the limit but by an artifice this is got around and *any* amount of amplification may be obtained; and because it is in a field beyond the hitherto recognized limit, it is called *super-regeneration*.

Let us first study a few basic points regarding ordinary regeneration. As is well recognized, it consists of supplying energy by some process akin to feed-back in such a manner as to enforce the oscillations in the circuit, causing them to attain greater amplitude and thereby having the same effect as would the introduction of "negative resistance". That is, part of the positive resistance which the circuit normally would have seems to have been overcome, we say that by the use of regeneration its effective resistance has been lowered. Now, obviously, the "negative resistance" created by the feed-back may be not as great as the positive resistance, or it may just equal it, or it may be greater than the positive resistance. Let us examine each of these in turn:

When the negative resistance is less than the positive (which is the case in our regenerators of today), the oscillations in the

circuit attain a steady amplitude of a value dependent upon the effective resistance; this amplitude is always finite, is reached in a finite time, and dies away to zero when the exciting e.m.f. is removed. Now when the negative and positive resistances are equal, the resultant effective resistance of course is zero. When an e.m.f. is impressed on such a circuit the current builds up at a rate dependent upon the voltage and certain other considerations and continues to rise as long as the e.m.f. is impressed. If it is impressed forever, the current reaches infinity; if for a finite time, then the oscillations have a finite amplitude; if at any time the exciting e.m.f. be removed, the oscillations continue forever at that same amplitude, for the circuit has no resistance. This is merely a theoretical case

in the use of a free oscillation to produce amplification. It is the purpose of this paper to describe a principle of operation based on the free oscillation which is quantitative and without a lower limit. This new method is based on the discovery that if a periodic variation be introduced in the relation between the negative and positive resistance of a circuit containing inductance and capacity, in such manner that the negative resistance is alternately greater and less than the positive resistance, but that the average value of resistance is positive, then the circuit will not of itself produce oscillations, but during those intervals when the negative resistance is greater than the positive will produce great amplification of an impressed e.m.f."

In other words, currents would increase

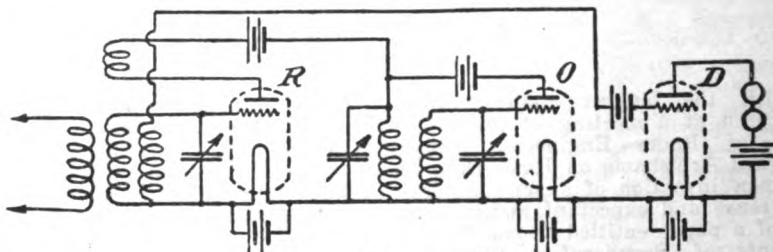


Fig. 1

and cannot be attained in practice because of the imperfections of vacuum valves. Now when the negative resistance is greater than the positive the effective resistance of the circuit is negative and the free oscillations set up as the result of impressing an e.m.f. build up to a theoretical infinity regardless of whether or not the external e.m.f. is removed. The rate of the building-up progress is dependent upon the amplitude of the starting e.m.f., which in turn depends upon the ratio of the negative and positive resistance and will be greater if the negative resistance is increased. No oscillations will occur until an exciting e.m.f. is impressed, but once that takes place, no matter how small it be, the current builds up to infinity.

With this understanding of the regenerative effects in an audion circuit, note what Mr. Armstrong said:

"It is, of course, impossible with present-day instrumentalities to set up a system in which the negative resistance exceeds the positive without the production of oscillations in the system, since any irregularity in filament emission or impulse produced by atmospheric disturbances is sufficient to initiate an oscillation which builds up to the carrying capacity of the tube. It is, however, possible by means of various expedients to set up systems which avoid the production of such a paralyzing oscillation and which approximate the theoretical case

to infinity and enormous amplification be possible if a non-oscillating circuit of negative resistance were available, but all such negative resistance circuits oscillate when excited. Mr. Armstrong accordingly sought and found a method whereby the effective resistance of ordinary regenerator may alternately be increased and decreased at a very rapid rate, whereby the negative resistance that obtains when the negative resistance is greater than the positive will serve to give great amplification and yet in the next instant when the positive resistance predominates its effect shall be such as to prevent oscillation. In still simpler words, the effect is much as if he had a rapid-action switch which fed alternately into the circuit a negative and positive resistance.

This scheme has all the benefits of radio frequency amplification *per se*, as it is a "first power" device, the amplitude of the effects depending upon the amplitude of the impressed e.m.f. Half of the time it is creating amplification (and the amplification when negative resistance predominates continues to rise even if the exciting e.m.f. is removed) and the other half of the time it is "killing oscillation". There is no theoretical limit to the degree of amplification without oscillation—it is limited only by the carrying capacity of the tube. There is no reason why the very weak signal of an amateur station across the continent



may not be fed into a 250-watt power tube and a quarter kilowatt of signal-modulated output made available if desired.

Now to secure this desired periodic variation in the ratio of the two resistances the negative may be varied with respect to the positive, the positive with respect to the negative, or both may be varied simultaneously, any one of the methods producing the super-regenerative condition. The rate of variation is an important matter and

Fig. 1 shows a practical circuit in which the negative resistance is varied while the positive resistance is held constant. This circuit is recommended for C.W. and for spark, the latter presumably "on the mush". Valve R, the super-regenerative amplifier, is a conventionally arranged regenerator except that in its plate circuit is an inductance-capacity combination that is likewise in the plate circuit of another tube O, the oscillator which creates the resistance varia-

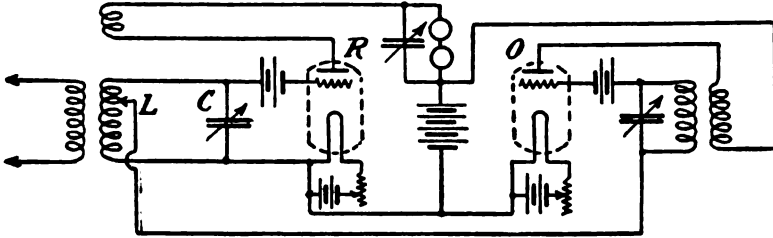


Fig. 2

depends upon the nature of the received signals. At best the choice is a compromise, particularly in telephony, as the lower the frequency the greater the amplification and the higher the frequency the better the quality. For telephony this variation frequency must be above audibility, and the same applies for I.C.W. and spark telegraphy if the natural tone is to be preserved. If one does not care about losing the natural note of the signal, then a lower

frequency of the variation depends upon the oscillation constants of valve O. Generally this is at an audio rate, the inductances in O's circuit being of the order of 10 to 20 henries, and of course both tubes have a big audio component in their currents. For this reason a third valve, a detector D, is coupled to the main radio-frequency induct-

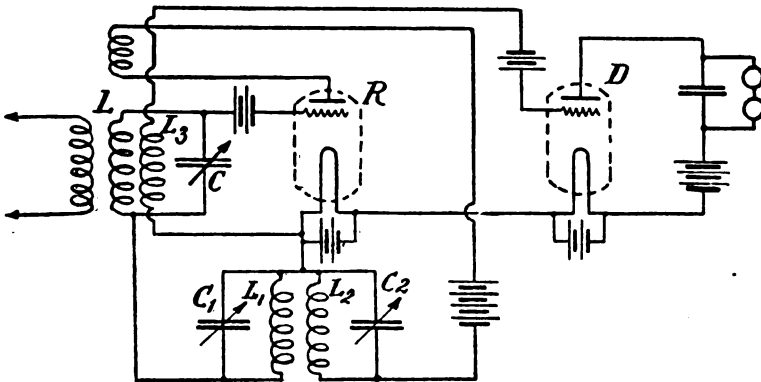


Fig. 3

frequency may be employed with greater amplification and a signal like receiving a spark on an oscillating regenerator. For C.W. telegraphy, where an audio note is essential, the variation frequency may well be 500 or 1000 cycles, but this note would be the same for all C.W. signals and for better selectivity the variation frequency may be beyond audibility and a separate heterodyne used, thereby securing heterodyne selectivity and this system's super-amplification.

ances and the phones placed in its output circuit; but if a super-audible frequency is used in valve O the phones may be placed directly in the plate circuit of the amplifier R, and that case of course, sparks would be received on their natural note.

Fig. 2 illustrates the variation of the positive resistance with respect to the negative, and is a circuit more fitted to the reception of phone. The positive resistance of the regenerative amplifier-detector R is varied by means of an oscillating tube O, whose

tuned circuit is completed back to filament via the inductance  $L$  of valve  $R$  and accordingly varies its effective resistance. When the grid of valve  $O$  is negative it has no effect and circuit  $R$  has normal resistance but when the oscillator grid becomes positive it practically shorts the inductance  $L$  and creates the effect of an excess of positive resistance therein. Altho this circuit may employ an audio oscillator at  $O$ , it is customary to use it at a super-audible frequency, particularly for telephone reception.

Fig. 3 shows the third case in which both positive and negative resistances are simultaneously varied. For the real amateur who wants to have lots of fun with sixteen

tery, producing two frequencies in the circuit; one at signal modulation frequency and the other at variation frequency ( $O$ 's frequency, as determined by  $L_1C_1$ ) with a super-imposed signal frequency component. This latter, being in tune with the valve  $O$ , is amplified by its regenerative action and then rectified, and hence heard in the phones.

What anybody wants to cascade super-regenerators for we don't know, but Mr. Armstrong spoke about it. It seems tremendous reaction troubles are experienced when this is tried, but may be got around by a simple expedient: the second harmonic of the first amplifier valve is very strong,

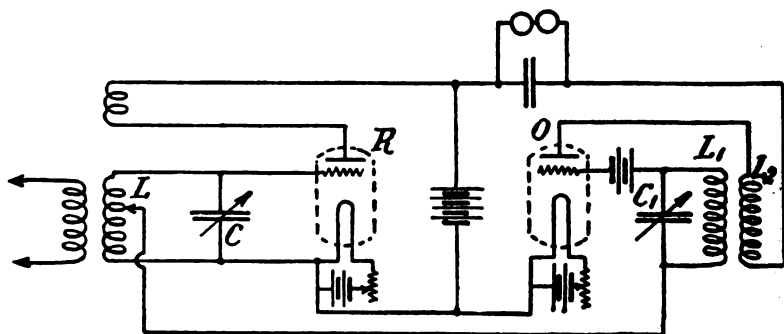


Fig. 4

or so adjustments, Mr. Armstrong recommends this circuit. Altho it is very critical of adjustment and extreme care is necessary to obtain the super-regenerative state, he says it produces more amplification than either Fig. 1 or Fig. 2. In Fig. 3 the amplifier  $R$  has a second feed-back circuit  $L_1C_1$  and  $L_2C_2$ , whereby it oscillates at some lower frequency. This does two things: (1) it creates a superimposed variation of the negative resistance generated in the plate circuit of  $R$ ; and (2) at the same time it produces a variation in the positive resistance by varying the grid of valve  $R$ . The question of phase relationships between the positive and negative resistances is handled by a variation of the coupling between  $L_1$  and  $L_2$  and by adjustment of capacities  $C_1$  and  $C_2$ , there generally being a disparity in their values. The separate detector  $D$  is necessary as a rectifier.

Mr. Armstrong uses hard tubes only, rectifying on the lower bend by virtue of a negative grid bias and without condenser and leak. When the variation frequency is above audibility the detection may be accomplished in the oscillating tube with still greater amplification, as shown in Fig. 4, but the circuit is harder to adjust. Its action is likewise difficult to explain but is somewhat as follows: incoming signals are amplified and become impressed upon the input circuit of the oscillator  $O$ , where they are rectified by virtue of the grid bias bat-

and if the input circuits of the second valve are tuned to this harmonic, reaction is avoided. Mr. Armstrong showed a diagram in which the two steps of super-regeneration had their positive resistance varied by a single tube-generator as in Fig. 2 but with the second stage tuned to the second harmonic of the first stage.

The circuit diagrams above have contemplated coupling the super to the antenna by means of tuned circuits, but Mr. Armstrong says trouble is often experienced in this due to the fact that the free oscillations continue during the interval when the resistance is positive and re-excite the amplifier when the resistance becomes negative, with the result that the system oscillates. Accordingly he recommends that the tuning be done at one frequency and amplification at another, which of course is best accomplished by some super-heterodyne method. To accomplish this one would merely introduce an independent detector ahead of the super-amplifier and beat upon it with a separate heterodyne to create the amplifier frequency at which the super-regenerator (of whatever type) operates.

This system of amplification is free of interference from sparks—shock excitation is eliminated. In ordinary spark reception what is heard is a free oscillation produced by the shock of the forced oscillation representing the spark signal energy, but continuing long after the latter has ceased. In

the super-regenerator there is periodically sufficient positive resistance to wipe out this oscillation and hence it is not heard.

Mr. Armstrong gave a demonstration. A small C.W. driver was rigged up across the room and signals received on a loop. Connected to a regenerative detector with two steps of audio amplification, no signal was audible where we sat, about 25 feet from the loud-speaker; yet when the super-regenerator was connected in with two tubes, one as an oscillator-amplifier and the other as detector, with audio frequency variation, the same signals were QSA. It was estimated that the amplified signal energy in the latter case was between 10,000 and

50,000 times as great as in the former. The same experiment was performed on the telephone signals of WJZ with similar results. Mr. Armstrong said he had compared a 2-valve super-regenerator with a super-heterodyne working at zero beat for phone reception (number of valves in the super-heterodyne amplifier not stated but just suppose it's only two) and found the amplified signal energy of the new system 100,000 times as much as the super-heterodyne.

In the short time available to get this copy to our printer's we have had no opportunity to test the circuits ourselves but will expect to present some practical working data soon.

## The Police Chiefs Relay

*By Boyd Phelps, Assistant Editor*

ONCE more amateur radio showed its worth in relaying this time to the Police Chiefs. Nearly every city, town, or burg that boasts a Police Chief or Sheriff received the message. The novel part of this relay was that no prearranged schedules were made nor did anyone know exactly when the message would start or by whom. Several thousand receiving stations participated in the relay, picking up the message and delivering it to their respective Police Chiefs. Keen excitement was evident in waiting for the message. Then someone nearby would pick it up and broadcast it to the rest of the gang.

The scheme was to listen after 10 P.M. local time on June 3rd, 4th, and 5th for someone to break loose with the message. In many localities the air was in absolute silence listening for the message. Many times it would be heard coming nearer but fading or swinging would cause part of the text, address, or signature to be lost. The silent competition between receiving stations was intense until some station got a complete copy. The rush then was to deliver it and then broadcast it to others who would pick it up and do likewise.

The message was first broadcasted on spark and C.W. on both 200 and 375 meters by several stations who opened a sealed envelope containing the message. The message was as follows:

*Nr 1 fm San Francisco Cal 3rd—  
To All Police Chiefs and Sheriffs—  
Please attend Convention of International  
Association of Chiefs of Police at San  
Francisco June nineteenth nineteen hundred  
twenty-two—  
(Sig) August Vollmer, Chairman.*

In many localities the message was not picked up the first night due to lightning and bad weather conditions which are always more or less prevalent during the

summer months. In fact in a few cases it was not until the third night that it was absolutely certain the copy was correct due to very adverse receiving conditions. Since then Headquarters has been flooded with copies of the message receipted by the various officials all over the nation thus showing the effectiveness of the relay.

Several incidents in the relay were quite interesting. 2BDR, after struggling with terrible QRN to get the message, had a worse job to get his copy signed, as the sleepy Chief when awakened and given the message said he knew about this convention the last day of the last convention and he didn't need a radio invitation, but was going anyway. 2BPL forgot about the relay but just happened to run across the message while helping a friend with a crystal set "who wanted to hear music for twenty dollars very clear and loud" so he copied the message and promptly delivered it. 9APW picked up the message many times but it was impossible to deliver it until the next day because he had his small sister to watch while the family was away. 7WG up in Idaho had a bad electrical storm on the only night he could be on and with the Sheriff sitting at his side he tried desperately to get a complete copy of the message but always missed certain words. 8ANB handled his message over to a very snappy Chief who would not sign his extra copy. 8ANB thinks from the way he acted he was not in good standing with the International Association of Chiefs. 8NY spent considerable time trying to find his Chief but says when he found he was out of town he got the other half of the force to sign for him. 2CEJ made a tour of surrounding villages and was the first to deliver the message to four Chiefs. 1CLK submits a regular affidavit from the Department of Police to the effect that he copied his message from 2FZ and delivered it at the above

office at 12:36 A.M. In fact it gave us somewhat of a shiver as the formidable letter was opened. 1PP had an awful job to get his dad to let him stay up but finally he got him interested in the relay and when the message came thru 1PP-Sr. got as excited as 1PP-Jr. and hitched up the car and son and dad together delivered the message. 3QV in Philadelphia had bad QRM from arc lights, rain and QRN were fierce, and conditions seemed about right for a murder. Parts of the message were copied from several stations during the night but not until 2FZ broadcasted it did 3QV drag out the mill and then the flivver to drive in the rain to the city hall.

In addition to the stations mentioned above, the following deserve special mention: 1DH, 1NW, 1OT, 1PR, 1AAK, 1ASY, 1BDT, 1BDU, 1BJP, 1BJS, 1BGP, 1BNL, 1BRL, 1BYV, 1CAB, 1CIK, 1COT, 1CQM, 2AR, 2CT, 2FC, 2FP, 2FZ, 2MN, 2OE, 2UU, 2AIF, 2AWQ, 2AWS, 2BCC, 2BDR, 2BNC,

2BOI, 2BXD, 2CBT, 2CEJ, 3BZ, 3LP, 3OI, 3TJ, 3XW, 3AAO, 3AAY, 3AEV, 3BAY, 4BX, 4MN, 5FO, 5ZA, 5XC, 5ZX, 6CC, 6CF, 6IV, 6VK, 6ZX, 6AAU, 6ACR, 6AJH, 6AJN, 6AJR, 6BAK, 6BKX, 6ZAF, 7BK, 7NG, 7NW, 7YA, 7ACA, 8AY, 8SP, 8UC, 8XU, 8YN, 8ZO, 8ZZ, 8ACF, 8ACM, 8AHY, 8ALX, 8ASL, 8AUE, 8AUO, 8AQO, 8AQZ, 8AXC, 8AXX, 8AXZ, 8BEP, 8BIL, 8BIW, 8BKQ, 8BLY, 8BNU, 8BPP, 8BND, 8BUQ, 8BXF, 8BXX, 8BYI, 8CEI, 8CMI, 8CTD, 9BK, 9EI, 9LI, 9WZ, 9ZJ, 9ZN, 9AAW, 9AEN, 9AFN, 9ALR, 9AMZ, 9BQW, 9DJF, 9DVD, WRR and Can. 3DS. Quite a quantity of stations having no call letters picked up the message, delivered it and forwarded us a signed copy.

Judging from the letters that have come in a great deal of fun was had by all. We have demonstrated what we can do in the summer static season and that it is the telegraphing amateur that accomplishes things.

## Some Suggestions Regarding the Beverage Antenna

*Which first rose to prominence in amateur circles when it was used in Scotland by Paul F. Godley in the A. R. R. L. Transatlantic Tests*

*By E. B. Dallin, 1FK.*

**T**HE Beverage antenna, is an exceedingly efficient collector of electromagnetic waves and is very directional when adjusted properly. It has its use especially in cases where communication between two fixed points is desired and where much interference is encountered. It has the advantage over the loop that it collects enormously more energy than the ordinary loop could ever collect and is unidirectional, giving absolute silence at a point 180° away from the station desired. This is a big improvement over the loop, which gives signals at a maximum from two directions 180° apart.

The system is very simple and, once adjusted, rarely needs any attention over a considerable range of wave lengths. The chief difference between the Beverage wire and the ordinary antenna or loop is that it is an aperiodic structure and consequently is not tuned in the ordinary manner, \*nor does its length bear an important relation to the wave length at which it is being used. The simplest Beverage wire, such as used by Mr. Godley in Scotland during our Trans-Atlantic tests, is similar to Figure 1. The length of wire to be used is usually specified as one wave length but it is not necessary to have such a long wire. For two hundred meters a wave length would

be nearly 700 feet but reasonably good results can be obtained with a wire of half this length. Below this length the signal strength falls off considerably.

Neither are its directional characteristics so exact that it must point precisely at the station desired. A variation of a few degrees makes practically no difference. For example, a Beverage wire pointing east will receive about seven-tenths the energy from the northeast or southeast and of course little or no signals from the north, west, or south. It is suggested that the subject of spherical triangles and great circle arcs be looked into before laying out a Beverage wire to receive from a long distance to the east or west so that it may be directed sufficiently to the north to compensate for the curvature of the earth.\*

Referring to Figure 1, the antenna A is a single wire which may be any height practicable, generally between six and eighteen feet. At the station end of the line is the transformer L<sub>1</sub>L<sub>2</sub> which couples the energy from the antenna to the receiving set. The exact values of the coils

\*Knowing the latitude and longitude of two points, A and B, the angle at B (β) between line AB and true north can be found by substitution in the following formulae:

$$\tan M = \frac{\tan(90^\circ - \text{lat. B}) \cos(\text{long. A} - \text{long. B})}{\cot(\text{long. A} - \text{long. B}) \sin(90^\circ - \text{lat. A}) - M}$$

$$\cot \beta = \frac{\sin M}{\sin(90^\circ - \text{lat. B}) \cos(\text{long. A} - \text{long. B}) - \cot(\text{long. A} - \text{long. B}) \sin M}$$

—Ed.

\*The Reinartz tuner seems especially adapted to this aerial, its exciting circuit being aperiodic in itself.—Ed.

will have to be determined experimentally as there is practically no data available as yet on the behavior of this system at short wave lengths. It is suggested that coil  $L_1$  for waves between 200 and 600 meters should consist of about 30 turns of No. 24 D.C.C. magnet wire on a three inch tube and  $L_2$  a tapped coil with a total of about 60 turns of the same size wire. The tightest coupling will in general be found to be best so as to get the maximum energy.

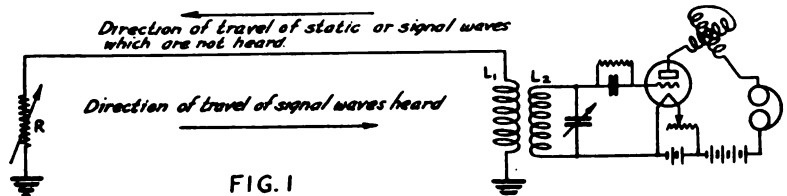


FIG. 1

The resistance  $R$  at the far end is very important. In the ordinary oscillating antenna the voltage is maximum at the end farthest from the lead-in so that reflection occurs at the free end. The function of the resistance  $R$  is to make the antenna aperiodic by allowing the voltage built up at the free end to leak off to ground. It absorbs all the energy that comes from the direction opposite to the signal and yet is sufficiently high so that the antenna system cannot act as a loop. The resistance should equal the inductance in henries divided by the capacity in farads (in absolute units) of the line. It is quite a difficult matter to make such measurements so that the usual method, especially for the amateur, is to make various adjustments of this resistance and find which one works best.

second method has been devised that overcomes this difficulty.

In Figure 2 we have two wires going to a transformer  $L_1L_2$ , the primary of which is grounded thru the non-inductive resistance  $R$ . Signals or other disturbances striking both wires equally go to earth thru the resistance and produce no effect on the set if everything is balanced, as the current induced in  $L_1$  by the halves of  $L_2$  will be equal and opposite. On the other end of

the wire the secondary  $L_1$  of the transformer  $L_1L_2$  connects to the middle tap of the primary  $L_2$ . When signals come from the direction indicated by the full line arrows, striking each wire equally, the signals have a path to ground as in the previous case, inducing no current in  $L_1$ , but the current to ground flowing thru  $L_2$  induces a current in  $L_1$  which circulates thru the two antenna wires as indicated by the dotted arrows. This circulating current, traveling thru both halves of the coil  $L_1$  in the same direction, induces energy in  $L_2$ . The receiver then responds to the signal and the system gives a directional antenna as before, but directional from the opposite direction to that of the single wire of Fig. 1.

In practice the wires are in a horizontal plane spaced from 12 to 18 inches apart

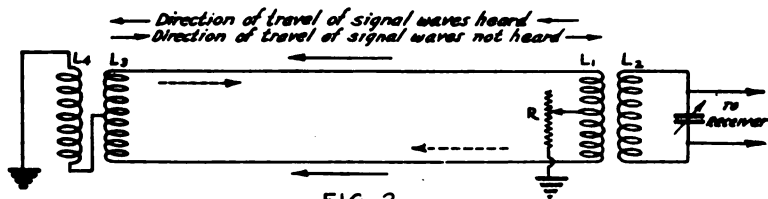


FIG. 2

The resistance probably will be in the neighborhood of 200 ohms and should be non-inductive and variable in small steps. The ground at the far end of the antenna need not be as elaborate as a transmitting ground because additional resistance is added in the rheostat. However, the ground should be deep enough to have a constant resistance for all weather conditions so it will not be necessary to make daily changes in the rheostat. The system when properly adjusted is so very much better than the ordinary one that it is well worth a large amount of effort.

The circuit described above has the disadvantage that the resistance is at the far end. As it would be much better if this adjustment could be made at the station, a

and the same distance above ground as in the case of the single wire.

For  $L_1$  and  $L_2$  wind 30 to 50 turns of No. 24 D.C.C. magnet wire on a four inch tube.  $L_2$  is a tapped coil of about 60 turns of the same wire wound on a tube three inches in diameter, and  $L_1$  is 30 to 50 turns on the same size tube. The coupling should be as close as possible between  $L_1$  and  $L_2$ , although it may be found desirable to loosen the coupling between  $L_1$  and  $L_2$ .  $R$  probably should be a variable resistance around 200 ohms. Due to the fact that there is considerable magnetic leakage in the two halves of  $L_1$ , there is likely to be reflection at this point so it is suggested that a variable condenser  $C$  and inductance  $L_3$  be inserted

(Concluded on page 58)

# Modulation in Radio Telephony

A Paper Presented by L. C. F. Horle\* at a meeting of the Radio Club of America, Columbia University.

**I**N discussing the subject of modulation as applied to radio telephony, I have nothing new to bring to you. In this article, however, I want to review the various methods of modulation which have been used in the past, and also to point out several lines of experimentation which should be followed up.

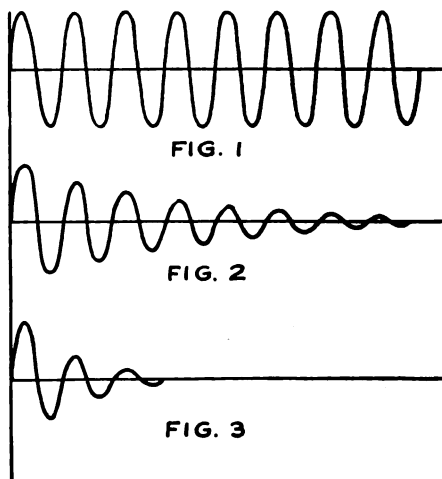
The problem of modulation is as old as radio. This may not be in the aspect in which we have become accustomed to think about it, perhaps, but, if we define modulation by "the degree to which the wave form of the radio-frequency current departs from constant amplitude", we find that this departure or degree of modulation is involved in the problem which we have been trying to solve in all types of transmitters.

In spark sets the attempt has always been to make the wave-form as nearly sinusoidal as possible. There are two reasons for this. First, the greater the departure from the continuous or sinusoidal wave, the greater has been the resultant interference; and second, the greater this departure the less power we are able to use with a given aerial. Figs. 1, 2, and 3 show more clearly what is meant by this. The last of these figures shows what we have been accustomed to call a highly damped oscillation, since the oscillations die out very rapidly. Fig. 2 shows an oscillation which is not so highly damped. Now, since the *average* height of this wave-form is a direct measure of the power in the circuit, it is evident that the wave form of Fig. 2 represents more power than does that of Fig. 3. The height of the first alternation is limited in both cases by the antenna circuit, since the value of the current cannot exceed a certain specified value without causing the antenna insulators to break down, or at least giving rise to serious corona with resultant losses. Hence it is important that the wave decay very slowly in order that the *average* value of the current may be as high as possible, resulting in a maximum of power in the antenna. We have termed this rate of decay the decrement or *logarithmic decrement* of the circuit and have worked to keep it as low as possible.

In the undamped transmitter we have secured a wave-form in which the decre-

ment is practically zero; that is, the wave shows almost no decay and is almost completely sinusoidal. (Fig. 1.) Having secured this long aimed-at result, however, we find that we have a type of radio wave which makes no impression on the usual radio receiver; that is, one which merely rectifies the incoming wave and passes the rectified current through the telephones.

It is of interest to trace through the receiving circuit to see what happens to a wave of this type. Fig. 4 gives the connection diagram of a simple rectifying circuit using a crystal detector. The wave form of the current impressed on the antenna is identical with that shown in Fig. 1, and the voltage which this develops across the detector is also of substantially the same form. But, due to the rectifying



properties of the crystal, it is converted into a wave form such as is shown in Fig. 5(a). This differs from Fig. 1 only in that the lower half of the wave has been eliminated, leaving merely the half on the upper side of the axis.

It is evident that a wave form approximating this one could be secured if a sinusoidal wave, as Fig 5(c), were superimposed on a direct current, Fig. 5(b). In the receiver, however, in order to make the incoming energy effective in the telephones, we separate the rectified current

\*Consulting Radio Engineer.

into these two components. The telephone and the telephone condenser are a very satisfactory combination for doing this. The telephone condenser will not allow the direct current component to pass, while the telephones, due to their high impedance to radio-frequencies, will not allow the high frequency component to flow. The result is, that the radio-frequency component is forced to go through the condenser, while the D.C. component is forced to flow through the telephones.

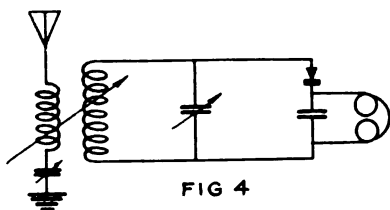


FIG 4

It is evident then that no signal will be audible in the phones if the transmitter is keyed in the usual manner. The only result will be a starting and stopping of a direct current through this part of the circuit. This accounts for the dull clicks which are heard when a continuous wave transmitter is operated near our receiving stations. Since a detector is probably less sensitive when a direct current is flowing through it, this also accounts for the "blocking" of the detector when a nearby and powerful transmitter of the undamped type is in operation, even though the signals from the latter station are not evident in the telephones.

Let us observe what happens when the transmitted wave is modulated, as in Fig. 6(a) where the current in the transmitting antenna never becomes zero, or rather where the wave never dies out. This is rectified by the detector in the receiving circuit as shown in Fig. 6(b), and then is broken up into its two components, Figs. 6(c) and 6(d), as described before. The high-frequency component passes through the telephone condenser, while the low-frequency component goes through the telephones and gives the signal. It is to be noted, however, that it is only the "humps" in the latter current which affect the telephones, and that the D.C. component passes directly through and causes no response. Thus if the modulation is not complete, part of the energy, while it is present in the receiving circuit and actually in the phones, does not make itself at all evident to the operator. It is essential, therefore, that all power that is available in the transmitting antenna be modulated by the voice, if the greatest signal strength in the receiver or the greatest range is to be attained.

This lack of complete modulation is the limitation which kept radio telephony from reaching its present stage of development for many years. The only requirement which had to be met in the construction of a radio telephone system, other than a satisfactory modulation scheme, was a high frequency generator of reasonable capacity. The latter has been available for years in the form of the arc, and recently in the form of the high frequency alternator.

The problem of modulating the arc has been unsolved for years, and even today no satisfactory method is available. This results from the condition which always exists in modulating a generator which of itself has no amplifying characteristics. To accomplish modulation in such a case, it is axiomatic that the power capacity of the modulator must be approximately equal to the power capacity of the generator. Thus in the case of a 5 K.W. arc, we must have as a modulator a source of voice power which is capable of delivering about 5 K.W. At this time there is no such source of power available.

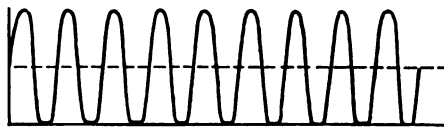


FIG. 5 (a)

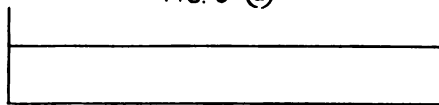


FIG. 5 (b)

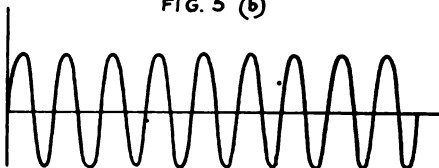


FIG. 5 (c)

This is evident from the inspection of a hypothetical modulation system shown in Fig. 7. Here we have a high frequency generator in shunt with a resistance, the value of which is caused to be varied by means of the voice. Let us observe what the conditions must be if this modulator is to completely modulate the output of the generator. The curves show the wave-form resulting from the operation of the modulator. Where the modulated wave form departs from the undamped, the power is evidently being absorbed in the modulator. The modulated and unmodulated wave forms are shown superimposed and the area of the unmodulated wave form not covered by the modulated wave form is proportional to the

power being absorbed by the modulator. It is evident that about as much power is being absorbed in the modulator as is being absorbed in the antenna. This relation is not at all precise, of course, but in a general way, the capacity for power absorption of the modulator must be about equal to the power capacity of the generator.

This unfortunate characteristic is the limitation which applies to all absorption schemes of modulation, and indicates the seriousness of the problem which is met in the attempt to modulate high-power generators such as the arc or high-frequency alternator when absorption methods are resorted to.

Systems have been worked out for the modulation of such generators by various schemes involving the use of the microphone. The oldest type of these is that which uses a telephone transmitter in the antenna circuit, where the change in the resistance of the microphone caused by the voice causes a change in the antenna current much as is shown in Fig. 7. This scheme was worked with varying degrees of success by the Federal Telegraph Co. on the west coast some ten or twelve years ago, and also by the DeForest Co. and the Collins Co. in the east, at about the same time. In all cases the power capacity of the microphone was the limiting factor in the operation of the systems, and invariably because of the limited modulation possibilities of this piece of apparatus, the transmission was extremely unsatisfactory. The capacity of the microphones was increased by water-jacketing and similar subterfuges, but even then only a small fraction of the power was modulated. A transmitter of 10 K.W. was barely sufficient for transmission over ranges of one hundred and two hundred miles, and even this was possible only under very good conditions. These several limitations which militate against the general use of absorption systems for modulation suggest the advisability of two other methods.

The first that suggests itself is one in which the power of the generator is made to vary by a control of its source of power in some manner whereby the criterion of equality of power capacities may be expected not to hold. The second is one in which the *reactance* of some part of the circuit is changed with a resultant change in the wave-length of the transmitted wave, or with a change in the current in the antenna. This latter scheme offers infinite opportunity for experimentation. Several methods have already been devised to accomplish this result, and others may be looked forward to in the future for the complete solution of the problem.

Dr. Alexanderson's method of controlling the high frequency alternator and Mr. Ernest Amy's magnetic modulator are the two that come to mind at this time. In the

former the generator is connected to the antenna in such a way as to include an iron core inductance, the reactance of which can be changed by the voice currents. The value of the inductance can of course be changed by providing the iron core with two windings, one of which carries the voice currents, and the other of which carries the working current, the voice current circuit being protected against the induced radio frequency current. The inductance and consequently the reactance of such a coil will depend on the values of the exciting currents in the windings. Variations of the values of these will change the flux

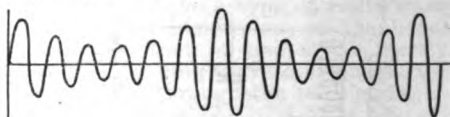


FIG. 6 (a)

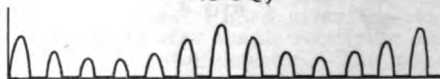


FIG. 6 (b)

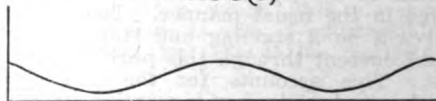


FIG. 6 (c)

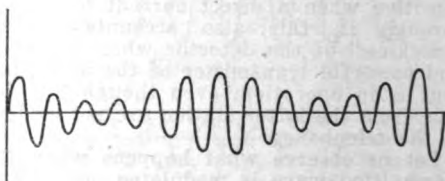


FIG. 6 (d)

density in the core, and hence the inductance of the coil as a whole. If such a coil is placed in the antenna circuit, or in a local circuit coupled to the antenna circuit, and tuned to resonance with it, the wave length of such a circuit will be varied by the voice current flowing in the exciting winding, and this change in wave length will cause the current in the antenna circuit to be modulated by the voice. This method has the advantage that relatively small amounts of power will cause rather large variations in the reactance of the coil, and hence vary the current in the antenna between very wide limits. For the control of a single 100 K.W. alternator, however, many times the power available in a microphone is required. However, the power required for modulating the output of such an alternator is, perhaps, not over 1% of the total output, and this is a tremendous improvement over the ordinary absorption method.



Mr. Amy's modulator is supposed to operate on a very similar principle, but it is probable that it is as much a loss device as a reactance device. It consists, I am told, of an iron core having an exciting winding which carries the voice currents and a winding which carries the power currents of the antenna circuit. The resistance and reactance of the antenna circuit winding depends on the flux in the core, and this flux is caused to vary with the voice currents. Thus the device becomes a rather hybrid absorption and reactance device and one in which the equality of power capacities does not hold very precisely.

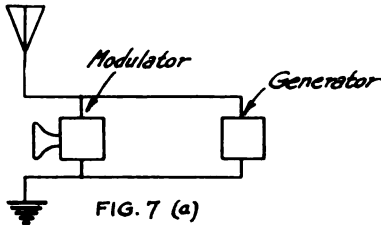


FIG. 7 (a)

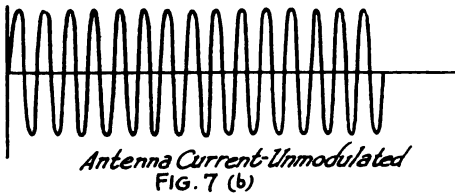


FIG. 7 (b)

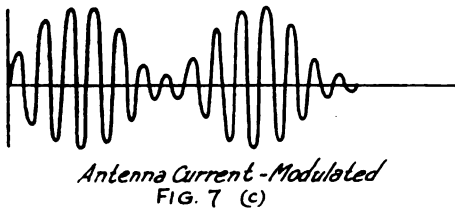


FIG. 7 (c)

It is conceivable that a scheme might be worked out whereby the reactance method of control may be used and the ratio of the power required to operate the modulator to the power which it will modulate made smaller than in either of these devices. It is along this line that the efforts of the experimenter should be directed. With the development of the high-power vacuum tubes now available and the special circuits and special equipment for their operation now developed, there still remains the problem of simple and efficient modulation. Until this problem is solved it is doubtful whether long distance radio telephone communication will be successfully accomplished.

The power-control methods, while the most commonly used, were the last to be developed, and the most effective of them are those which are applicable to the vacuum tube generator. The tube because of

its inherent amplifying characteristics suggests immediately the possibility of the control of large values of power by the use of comparatively small amount of power. In this connection the grid circuit suggests itself most forcibly for use in modulation, since this circuit is one of high impedance, very high in fact, and is furthermore a circuit in which the voltage which will reduce the power in the antenna circuit from its maximum to zero causes very little current to flow and consequently very little power to be dissipated. The objection to this method of modulation lies in the fact that it is very critical in adjustment, and also that great distortion is likely to take place unless extreme care is used in making adjustment.

Mr. Kischpaugh in his paper before the Radio Club of America some time ago showed characteristic curves which make this point very well. This is shown in Fig. 8. The grid voltage is plotted against the antenna current, and shows a rather slowly varying antenna current for high values of the grid voltage, and a very sharp dropping off of this current for lower values of this potential. It is evident that with the grid biased to make its mean voltage that of the point "c", the change in the antenna current will be small for a given voice voltage applied to the grid. On the other hand, for a mean grid voltage somewhere between "a" and "b" on the curve, the change in antenna current will be large for a given change in the grid potential. In addition there is very little power required for modulation when the grid is fixed at this latter potential, since the more negative the grid the less current and consequently the less the power required for modulation.

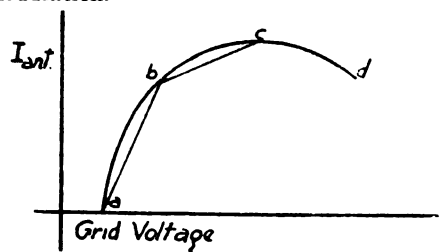


FIG. 8

Unfortunately, however, minor variations of the constants of the antenna or local circuit will destroy any adjustment which is obtained in the grid circuit, and only by constant readjustment can the circuit be kept in such condition that modulation is effectively accomplished. In addition to this, experience shows that with the usual care in adjustment which is given by the amateur to his transmitter, the grid-modulation circuit usually results in very serious distortion.

These then are the objections which militate against grid modulation. It has been used quite successfully and it appears that certain commercial companies are now planning on its use, but general experience indicates that some more reliable and easily adjustable method is essential.

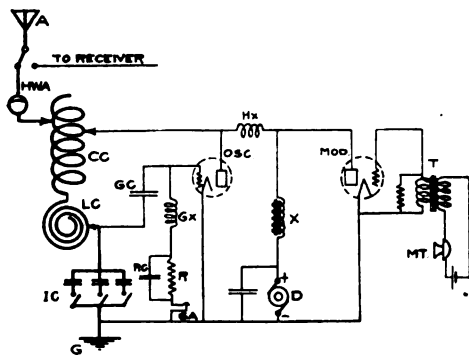


FIG. 9

The second modulation scheme that is in common use is the so-called "constant current" scheme or plate circuit modulation. This scheme is shown in Fig. 9, and this is the one with which we are probably most familiar. It may be considered either an absorption method or a power control method, depending on whether the modulator tube is viewed as part of the power supply or part of the generating circuit. This circuit operates by changing the voltage on the plate of the oscillator. This is accomplished by changing the current

thru the modulator by means of changes of the grid potential of the modulator tube. Because of the fact that the output power is reasonably proportional to the voltage on the plate of the oscillating tube, and this in turn varies with the voltage on the grid of the modulator tube, we have a scheme in which (when sufficient filament emission is available) distortion is not a serious factor, and one in which the adjustment is not seriously critical. Its outstanding advantage lies in the fact that the adjustments which are required for best modulation are in the main independent of the adjustments of the generating circuit. For this reason, if there were no other reason, it is to be preferred to the grid modulation scheme.

In closing, let me say that this segregation of adjustments or of control is the characteristic which differentiates all effective and easily-usable radio schemes and apparatus from the less usable types and that in any radio equipment which is to be successful, whether it be a radio telephone transmitter, an amplifier, a receiver, a loud speaker, or what not, the aim of the experimenter should be not only to make the most highly effective device but also to make one in which the various factors that go to make operation successful are separately controllable. This should be done even at a slight sacrifice of efficiency. If it is successfully carried out, the average efficiency of operation will be greatly increased over that of a device which is capable of much higher absolute efficiency but which requires infinitely careful adjustment because of the fact that its controls vary more than one factor at a time.

## New England Division Daylight Tests

By P. F. Robinson, Division Manager

ON Sunday, May 14, 1922, the N. E. Division of the A.R.R.L. conducted its first daylight relay on its routes from northern Maine to southern Connecticut, i.e., 1BRQ to 1AWB. The tests were arranged with the view of interesting the Operating Department personnel in daylight relay work and also in preparation for the first Daylight Transcons.

In order to make a fairly good showing it was necessary to notify about fifty stations that the tests would take place. This was done from one to two days before the tests and practically every station to whom notice was sent was on the job. In view of the short notice given this was very remarkable response and if such interest is displayed right along there is no reason why considerable traffic cannot be

handled during daylight on Sundays and holidays.

Complete logs were turned in by all but one of the stations which participated in the tests and from them a lot of very interesting and valuable information was gathered with regard to conditions in certain localities, fading of signals, relative value of spark signals as compared with C.W., etc. Unfortunately a fire in the radio shack at 1CK where all the records were kept destroyed everything but it is hoped to conduct further tests and keep the records in a safe or in some good place until they can be used.

The best work done was the transmission of a message from Connecticut to Maine and the reception of a reply at the station of origin inside of 56 minutes. Considering that a year ago this would

have taken at least two weeks, even at night, this was very good work. Subsequent examination of the log sheets turned in by the various stations showed that in many cases the messages were copied from stations several jumps away from them and that if the message had been sent as soon as first copied the time of delivery would have been greatly reduced. Eight messages successfully completed their journey during the schedule set for them and two others which got hung up somewhere came through the next night.

A peculiarity was observed in that no spark signals from stations south of Boston were heard during the test but stations north using spark were all heard o.k. while only one C.W. station came through from the north. The southern C.W. stations

came through steadily throughout the whole test.

A great deal of credit must be given to the following stations for efficient handling of traffic: 1ACO, 1ADC, 1AW, 1AWB, 1AZW, 1BRQ, 1CK, 1FM, 1FW, 1PR, 1QP and 1RV. Of these stations 1AZW was heard over practically the entire division, his call being listed in all but one of the logs turned in. Thanks are extended to the many other stations who were on the job but who did not take active part in the relaying or whom I may have left out on account of loss of their records in the fire.

In response to numerous requests more tests will be run and more time will be given in preparation for them so that the distances may be covered in shorter time.

## 5ZA Gets Hoover Cup for 1921

THE entries in the contest for the Secretary of Commerce's Cup for America's Best All-Around Amateur Station for 1921, in which the major portion of the apparatus is to be home-made, were considered by a special meeting of the A.R.R.L. Board of Direction on May 26th. It was of course, a process of elimination. When each director had studied all the entries and announced that he had made a decision in his own mind, the chairman called for a vote and it was *unanimously* in favor of Louis Falconi's well known 5ZA at Roswell, New Mexico.

The announcement that the Department of Commerce would give a handsome cup each year during the present administration to the best amateur station in the country, under certain regulations, was made in QST last winter. Chief Radio Inspector Terrell conveyed the glad tidings to our First A.R.R.L. National Convention. Secretary Hoover desired the cup to be given

under regulations to be drawn up by the A.R.R.L. Board of Direction but specified that it was to be primarily an encouragement to home-construction—apparatus built by the amateur. The rules for the contest were published on p. 20-22 of QST for last January. There is to be a cup each year. Because the scheme was late in starting, entries for the 1921 cup were received up to March 1st, and it is that award which has just been made.

By its terms Mr. Falconi is signally honored—of all the home-made stations in the contest his is unanimously voted the best. And everyone knows that 5ZA is a real performer and will be glad to see this recognition given his long and hard work. *Bravo, Falconi, attaboy!*

In our next issue we expect to have a photograph and description of the beautiful cup which secretary Hoover is presenting to the winner. This month we publish

### A Description of Station 5ZA

By Louis Falconi

5ZA was installed at the conclusion of the European War. The present set is the result of three years' improving and rebuilding. In every case efficiency has been the main consideration in the design and construction of the apparatus. However, good appearance was taken care of as much as possible and still maintain efficiency. The apparatus is entirely home-made and the layout of the units original.

The station can be divided into five parts:

- (1) 200-watt C.W., I.C.W., fone.
- (2) 1 K.W. rotary spark transmitter.
- (3) Switchboard.
- (4) Receiving cabinet.
- (5) Aerial and ground system.

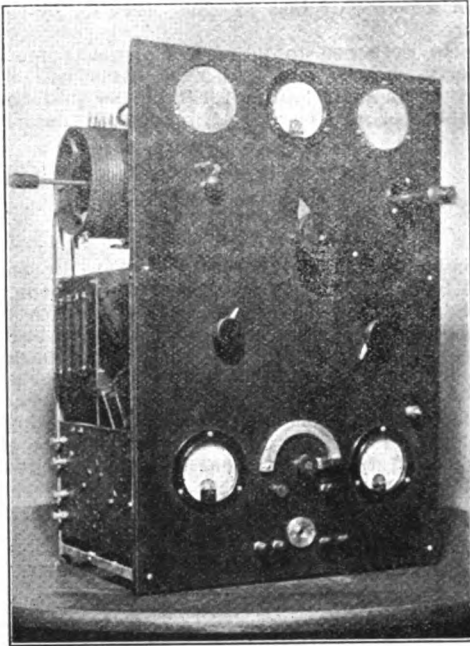
I will endeavor to give a complete description of the units.

#### The C.W. Unit

The C.W. unit is built to accommodate a total of 4 fifty watt power tubes and one 5-watt speech amplifier tube. The circuit used is a modified Hartley with Heising or constant current modulation for phone. All tubes are used for C.W. and I.C.W. Two tubes are used for modulators and two as oscillators for phone. The small 5-watt speech amplifier is automatically connected when the microphone jack is inserted.

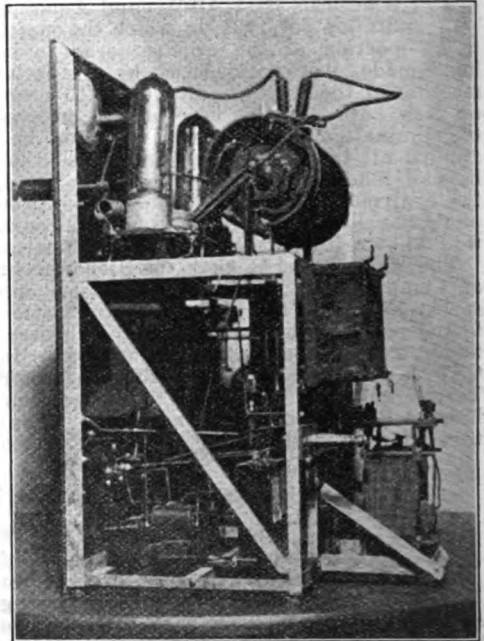
The entire set is mounted on a bakelite panel, 18 by 24 inches. The panel is supported by an aluminum frame (the alumi-

num was obtained from a wrecked aeroplane, cut into strips and bent like angle-iron.) Iron has been avoided as much as possible in the construction of the set, and all unnecessary metal of whatever nature has been left out. Another point followed in design of the set was the elimination of all variable condensers. The wiring diagram is given in Fig. 6. Grid coil adjustment is made by variable coupling and variable inductance, the combination of the two giving any adjustment desired.



Referring to front view of set: At the top center of panel is the thermo-couple radiation ammeter in the aerial lead. To right of said meter is the oscillator tube peep-hole and to left is the modulator tube peep-hole. Copper screen is placed over the holes. Just under the radiation meter is a large knob which controls the change-over switch, to throw from C.W. to phone. This switch is really two switches in one. One is a single-pole double-throw and throws the modulator grid from oscillating to modulating position and the other is a single-pole single-throw which shorts the radio frequency choke coil between plates in the C.W. position. The blades of the two switches are linked by a bakelite strip and thus one knob throws both. The small knob at right center controls the rheostat in the primary of the filament transformer, while the small knob to left of center controls the rheostat in the filament circuit of the speech amplifier. In the left lower corner is the filament voltmeter and the right lower

corner is the plate milliammeter. Between the two meters is a variable grid leak which is used in connection with a fixed leak for close adjustments. Under the grid leak is the microphone jack. This jack is fitted with two auxiliary contacts which close when the plug is inserted; these contacts control the lighting of the speech amplifier tube, the tube burning only when plug is in. The large post at the right of the panel is for aerial connection and the small binding post at lower right for ground. The small posts under the jack connect to the storage battery and to the transmitting key. In the upper left of the panel is a small switch to throw the voltmeter from power tubes to amplifier tube. On the side of the set may be seen the resistances used in the speech amplifier and the small panel on which is mounted the amplifier tube, modulation transformer, and fixed condenser. The handle controlling the grid coupling and inductance is also visible. Part of the antenna-plate inductance can be seen. Referring to the photo of the back of C.W. set: The antenna-plate inductance with



grid coil inside is plainly seen. The grid coil slides on two brass rods attached to the large coil tube. The large coil is wound on a 5-inch tube, threaded 5 to the inch, with 40 turns of No. 8 bare hard-drawn copper wire. Pieces of the same wire  $\frac{3}{4}$  inch long are soldered end up to every turn for taps, every other tap staggered about 2 inches apart. Plugs with holes to fit the wire taps are used for connections. The

grid coil is wound on a 4-inch tube, threaded to take 50 turns of D.C.C. No. 16 copper wire. Taps are taken every 10 turns and brought to a switch fitted to end of grid coil tube. The switch handle is extended so as to project from the side of the unit and a good insulating handle fitted to it. Thus the number of turns in grid coil and its coupling are controlled at once. The socket assembly is home-made and has 4 sockets to fit 50-watt tubes, all on the same bakelite base. Intergrid chokes and protective gaps are built in. The audio frequency choke in the D.C. power lead was made by winding about 4 pounds of No. 28 enameled copper wire on an open core  $1\frac{1}{2}$  inches square and 6 inches long. The same is mounted on a bakelite strip under the socket assembly. It is not known how near theoretically correct the construction of this coil is, but the results have been good and the modulation excellent. The rheostat at the left of the photo is in the filament transformer primary. The filament transformer is just back of this rheostat and is mounted to the back of the whole unit. The two large binding posts in front of the rheostat are for the 1000 volts D.C. The filter elements are plainly seen, two single coil chokes and two condensers. The amplifier tube on other side of unit is visible.

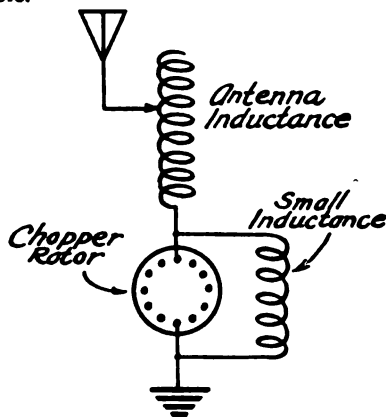


FIG. 1

It will be noted that the apparatus is so distributed that all roundabout connections are avoided. All connections in the oscillating circuit are short and direct. The wiring is done entirely with No. 8 copper wire for the power circuits and No. 14 for the modulation circuit. All connections are soldered. The complete unit is very rigid and easily handled. It might be added that to date only two power tubes have been used but full power will be available at sometime in the future.

Straight C.W. transmission is accomplished by shorting a 1 MF condenser in

the grid circuit. For I.C.W., a chopper is connected in the ground lead in a very novel way. To my knowledge I have not seen any description of this arrangement for the chopper. It is connected as shown in Fig. 1. It will be noticed that all the chopper does is to short a small inductance of a few turns of heavy copper wire, thus changing the wave length every time contact is made. If the inductance is made large enough, reception can be made on two waves. For best results, however, the change in wave should be only a few meters. This arrangement has the advantage of making the wave somewhat broad, and for calling it is ideal. A better method would be to have two chopper discs so that when one is in contact, the other is not. Thus the set could oscillate at one wave at a time only whereas with the other arrangement it is doubtful if all of the energy is actually modulated. Results have been perfect.

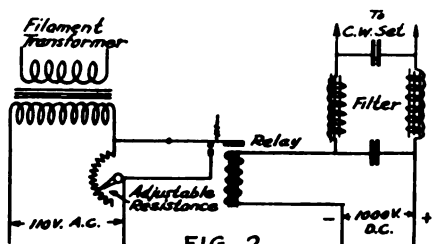
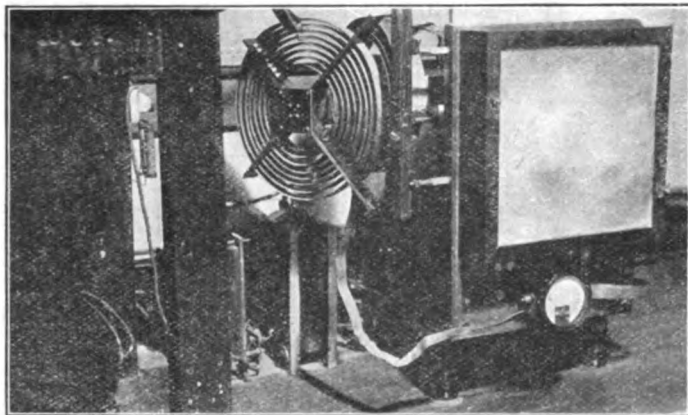


FIG. 2

When this set was first placed in operation, trouble was experienced from the drop in voltage across the power line when the generators took up the load. Every time the key was pressed the filament voltage went down. That spoiled the tone so that the compensating wave method of signalling was attempted. That system works OK as to tone but the disadvantages were so great that it had to be abandoned. It was soon found that the tubes could not be loaded to the same extent, that it was not very economical, and also that the compensating wave caused QRM. The flickering trouble was solved by the arrangement of Fig. 2. As will be seen a small variable rheostat is connected in the primary circuit of the filament transformer. A relay is connected so that when closed the active portion of the resistance is shorted. The winding of the relay is connected in the negative lead of the 1000-volt circuit supplying power to the plates. The action is as follows: when the key is open, the tube filament current is limited by the resistance, but upon closing the key, power flows thru the relay closing same and shorting the resistance. Now the tendency is for the filament current to rise but since the voltage across the power line drops, the drop and rise neutralize and the filament voltage remains constant. By



1 inch wide. Two heavy battery charging clips are used for the variable contacts. The clips are made of brass, the jaws straightened and the lead covering burned off.



A kick back preventer was made out of two high-resistance rods mounted on a fuse block as shown in Fig. 3.

#### The Switchboard

The switchboard controls all power circuits and also shifts the circuits so that the same change-over switch can be used to control either the C.W. or spark set. A large ammeter shows the power input to the transformer. Switches control all of the power, gap motor, transformer primary, high voltage D.C., and a change-over switch is provided to change power connections to the main antenna change-over switch. Fuses are placed in the power line. The photo of the complete station will give an idea of what the switchboard looks like. See also Fig. 4. The main change-over switch is just in front of the switchboard. It controls the power to either the C.W. or the spark set depending on how the small switch on the switchboard is thrown. For switching the antenna connection from C.W. to spark, the O.T. clip is simply taken from the O.T. and clamped to the antenna post on the C.W. set.

#### The Receiver

The receiving set can be seen in the photo of the station. See also Fig. 5. It is a variometer regenerative set with two steps of audio amplification. It is home-made and standard units were used in its assembly. A switch is provided so that the amplifier can be used with separate receiving apparatus. Jacks are used for switching to either step and also for two sets of fones. This set has been used two years and has proven very sensitive. On one occasion, a Ford spark coil used by an operator on a ship just out of San Francisco was heard and worked with. The set receives the C.W. stations as readily as the spark. In the photo of the complete station, the re-

ceiving set is the cabinet to the extreme left. Above it may be seen a wavemeter.

#### The Aerial System

The antenna system uses two masts 67 ft. high. These masts each comprise three sections, a wooden section for the bottom and two lengths of pipe hauled up on the wooden sections. That construction allows easy take-down if repairs are needed. It is very easy to erect such a mast, one of them having been raised by the writer without any help. The guys are broken up into 20-foot lengths by insulators. Turnbuckles are placed in every guy.

The antenna proper is comprised of 4 stranded wires in T-type. The flat top is 90 feet long. The spreaders are 14 feet long and the wires spaced a little over 4 feet apart. Two 10½ inch Electrostatic insulators in series are placed at the end of each wire. The lead, taken from the middle, comes down in fan style and is bunched just before entering the station.

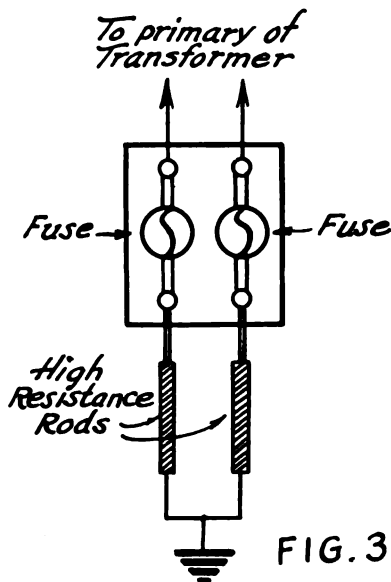


FIG. 3

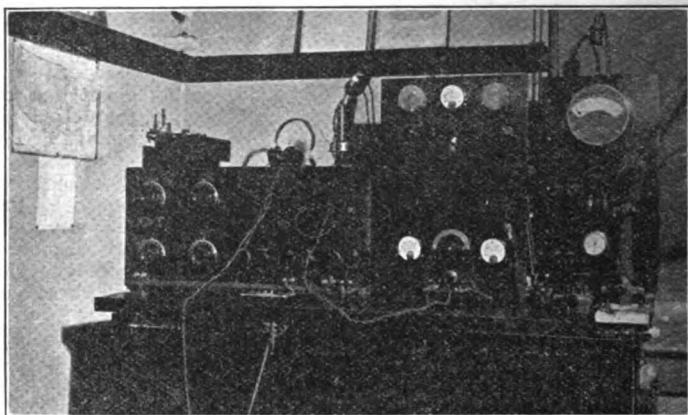
The counterpoise consists of 6 wires starting from a point at the station, which is near one of the masts and spreading out in fan shape towards the other mast where the ends cover a space of 50 feet. A more elaborate counterpoise is planned.

Earth connection is made to three buried hot-water tanks, to pipes, and to buried wires.

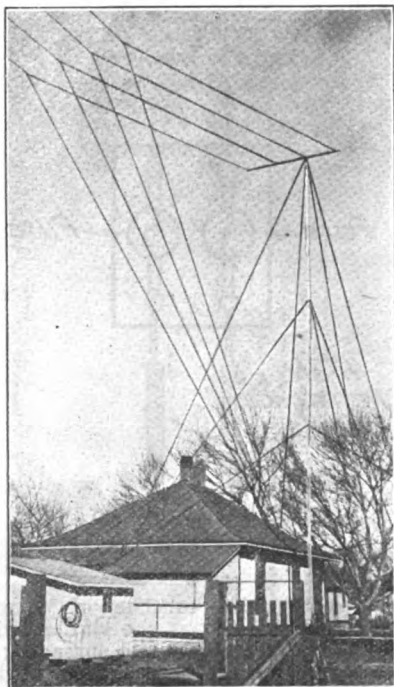


### Results

The C.W. set has been used most of the time with only 500 volts on the plates of the power tubes due to lack of the other 500 volts, which was just recently obtained.



The C.W. sigs have been reported from every state except Maine. ITS reports signals 30 feet from the fones using 1000 volts on the plates, and 10 feet from the fones when using 500 volts. Only one tube



was used for reception. Only two power tubes have been used to date. Mr. C. J. Dow of Wailuku, Maui, Hawaii reports as

follows, "Your sigs QSA here every evening, please QST to me". During the month of December, the amateur both-way communication record was broken when direct communication was established with 2ZL and

msgs. exchanged. Mr. Godley, in his report on the Transatlantic Tests in QST says "I wish to express my thanks for the assistance unwittingly given by one Mr. Louis Falconi, station 5ZA, Roswell, N. M. It will be a great surprise to him when he learns that covering a period of about one week prior to my sailing, during which time the apparatus which I was to use was under test, I used his very uniform signals to check and recheck operation of the equipment. I did not only receive his signals on the regenerative and two steps but also was able to get him nicely on a *nine turn loop* in conjunction with a super-heterodyne receiver, when his signals were of such strength and regularity as to enable the operation of a *4-ohm sounder* by the insertion of relays in the circuit". Mr. Godley was at that time in New Jersey.

The following stations have been worked with: 2ZL, XF1, 8ZZ, 7XF, 8ZG. NWO while off coast of Virginia. Cloi in the state of Washington. 5ZA has been reported from every state except Maine, also from Toronto, Vancouver, Morse, and Ottawa, in Canada; ships as far as 1500 miles out in the Pacific, ships off the coast of North Carolina, ships in Honduras. During the Transcons last year, the spark transmitter was one of the transmitters taking part in the transcontinental record and connected 9ZN with 6JD.

The radiophone has been reported heard in the following states: Calif., Nevada, Utah, Minn., Mont., Wyo., Wisc., Indiana, Missouri, Louisiana, and other states closer. Actual conversation has been established with 9XM, 9YAE, 9ZU, 5XB, 5XU, 6TV, and Juarez, Mexico.

It is regretted that a complete log of 5ZA can not be had. The traffic going thru



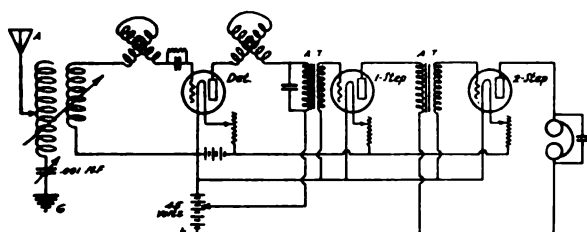


FIG 5 WIRING OF THE REGENERATIVE RECEIVER

5ZA is very heavy. There is only one operator and the distances covered are so great that transmission is always done under difficulties due to long distance QRM. Therefore it takes all one's time to relay messages and very little is found for logging, only unusual distances and records being taken down.

## Some British Tube Equipment

**T**HROUGH the courtesy of Messrs. Burnham & Co., London manufacturers of amateur radio equipment, QST has had an opportunity to inspect and test one of their "Ultra III" Receivers. The Ultra III, we take it, is representative of the best in British amateur apparatus.

Now when an American amateur gets hold of a new set there are three things he wants to know:

What does it look like inside?

What's the circuit?

How well does it work?

To our delight, both the set and its tubes arrived in perfect shape. Altho called a receiver, it should be noted that this is tube equipment and that no tuner is embodied. It is generally used in connection with honeycomb coils. The most outstanding thing about its appearance is that it is meant to sit horizontally on the table, in marked contrast to the vertical-panel style now exclusively used by American manufacturers.

Referring to the photograph of the exterior, the three tubes are respectively a radio frequency amplifier, a detector, and an audio frequency amplifier. The switch in the center of the panel tunes the radio stage. Next are two telephone switches for tube controls, and at the bottom are the three rheostats.

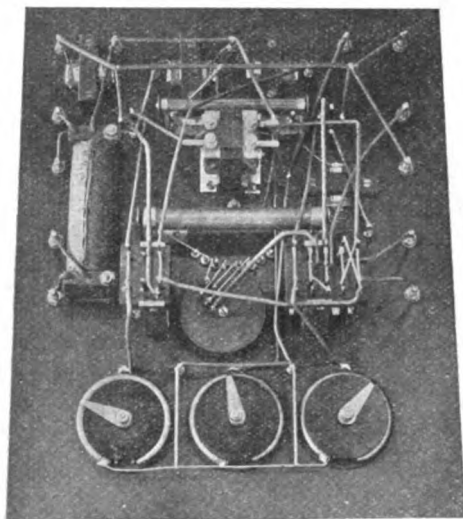
Upon getting inside the set, imagine our surprise at seeing a regular American-built Federal 226-W amplifying transformer for the audio stage! The workmanship and material thruout the set are wholly above criticism—flawless—but vastly different from American practice. We of course are used to seeing a tube set arranged like a Ford factory—the input coming in one side to the first tube, leaving its output to enter a transformer whose output feeds to the second tube, and so on across a long narrow cabinet in which the tubes and transformers are arranged as nearly as possible like a schematic drawing. The Burnham set is vastly different, as it must be in a

flat set with an almost-square panel. The wiring runs in every direction and one needs pencil and paper and a half-hour off to trace out the circuit. It's "all there", however, and much ingenuity has been displayed in arranging the spaghetti-covered leads in tripod formation so as to be self-bracing in running from one side of the panel to the other. Physically the set is as good a job as we ever saw, altho we cannot admit being intrigued by its particular style of beauty—we prefer logically-arranged vertical-panel sets ourselves.



The large coil on the left in the inside photograph is, as may be guessed, the step-down telephone transformer. Altho arranged for use with high-resistance phones, the British prefer phones of about 120 ohms, which of course requires a telephone transformer. The various condensers are all mica-and-copper, securely screwed down beneath ebonite strips. Above the Federal transformer is the 2-megohm Mullard grid leak, while below it is a larger one of 80,000 ohms used in the radio repeating circuit. The radio-frequency reactance, about which we shall say more in a moment, is in the

form of a bobbin with five taps, connected to the switch points. On either side of it are the control switches which are most sturdily built and seemingly fool-proof, while across the bottom are the three rheos, smooth-running and reminiscent of our Remlers.



Now for the circuit. Figure 1 shows the scheme when all three valves are employed, the middle or detector valve being arranged for regeneration. The method of coupling the radio amplifier to the detector for waves below 5000 meters is that known as reactance-capacity, while resistance-capacity coupling is used for higher waves. The reactance-capacity method consists in effect of tuning the output circuit of the radio amplifier by the selection of the proper amount of inductance, the voltage drop across it caused by the signal of course being greatest at its resonant frequency. This arrangement will be better understood by reference to Mr. Higgy's Figure 2 on page 35 of QST for last February. For long waves there is no need for adjusting this anode circuit and in the Burnham set when the selector switch is placed on the right-hand stud marked "Long", the 80,000-ohm resistor is cut in to the circuit (in series with all of the reactance) and it becomes essentially a resistance-repeater arrangement.

Altho our diagram shows the set connected with three coils, the British amateurs commonly use with it with but two, having but one tuned circuit and with tickler feed-back.

It should now be possible to understand Fig. 2 without difficulty. The main thing is the switches,  $S_1$  and  $S_2$ . These are two-position switches and when both are in the "Off" position the tuner and phones are connected to the detector alone. When  $S_1$  is

thrown to "On", the detector output is diverted from the phones to the audio amplifier transformer, the amplifier filament is lighted, and the telephones are automatically in the amplifier plate circuit. Similarly when  $S_1$  is "On" the high-frequency amplifier is lighted, the input diverted to its grid circuit, and its output then connected to the detector. Now here is an interesting thing, perhaps little appreciated by the average American amateur. Everyone knows that a tickler connection works only one way and that sometimes in hooking up apparatus it may have to be reversed to get it correct. When, now, it is correct for a detector (and audio amplifiers if used), if a single stage of radio amplification is used before the detector, the tickler must be reversed, for the electrical signs have changed. Thus the switch  $S_1$  is equipped with extra blades which automatically reverse the tickler connections as between detector alone and when it is preceded by r.f. amplification.

So much for the set. The valves are nicely made and work very well. All are hard tubes, working on 60 to 75 volts B battery. Their detector, so hard that a grid leak is essential, is as sensitive as most of our gaseous tubes and more stable. Altho requiring but 4 volts, the set is operated on 6 volts to get the proper grid biases by means of the drops across the rheostats. Our only criticism of the tubes is that whenever the set is jarred, even gently, the tubes "ring" like a fire-gong.

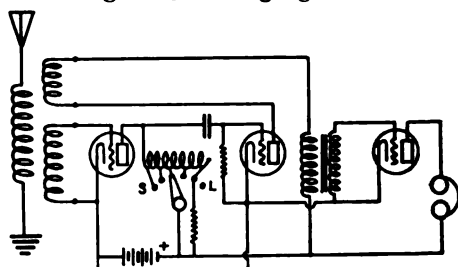


FIG 1

When we first tested this set we hooked it up to a short-wave regenerative receiver with loose coupling, condenser tuning of the secondary, and we connected in the usual regenerative variometer instead of using a tickler. The rectifier and audio stage worked as prettily as any detector-onestep we ever had but the radio stage wouldn't work at all. The first night had passed before we awoke to the realization that the tuned-plate-circuit method of regeneration couldn't be used in connection with a single stage of radio amplification ahead of the detector, because the polarities were wrong—and that reversing the variometer leads wouldn't help. So the next night we tried Coto-Coils, using tickler-feedback, and got excellent radio-amplification on 600 meters without regeneration.

When we had the set working well on 600 meters, with good r.f. amplification, we were using no tickler reaction and found that any at all would put the bulb into oscillation. Cutting out the r.f. stage and reverting to detector, where the regeneration could be accomplished, the signals were just as loud, as nearly as we could tell.

our three precious tubes gave a violent blue "plick!" and went west at three hundred million meters per second. As yet we have not received additional ones and so can make no report on the operation of the set on short waves. Mr. Burnham tells us, however, that the radio stage works excellently on 180 meters.

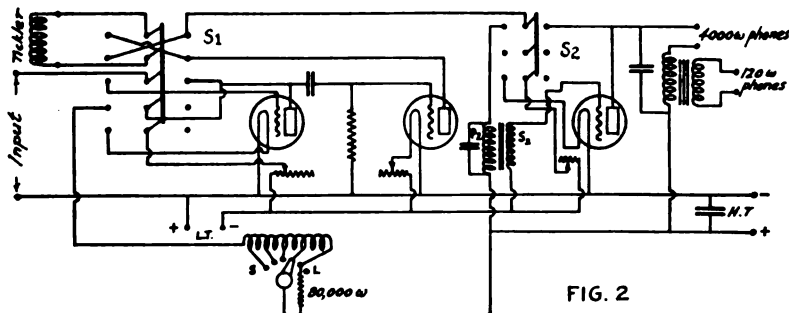


FIG. 2

Results on 200 meters, however, were nil, strong local signals dwindling to faintness when the radio stage was cut in. A cruel trick of Fate's prevented our ever discovering the trouble. The bloody symbols on the set, "L.T." and "H.T." (low tension and high tension) for the "A" and "B" batteries, respectively, got us all mixed up and so we mixed them all up, and two of

This test was made on ship traffic off the Atlantic coast. We have had much the same luck every time we have endeavored to use r.f. amplification on short waves—regeneration must nearly always be sacrificed, and it takes one or two stages of r.f. amplification to overcome this loss before additional benefit begins to be experienced.

—K. B. W.

## An Explanation of the "Chicago Plan"

By R. H. G. Mathews

April QST recorded the award of the Smith Trophy to the Chicago Executive Radio Council, partly for the conception of the co-operative plan of local amateur government known as the "Chicago Plan". Doubtless many of our newer readers wonder what this scheme is, and we therefore have asked our Central Division Manager to give us a brief explanation of its functioning.—Editor.

**I**F in past years definite organization among the various individual radio clubs and groups in large cities was desirable, in these days of hectic radio interest with new clubs springing up over night, their membership being composed perhaps of the most influential and wealthy men of their various communities, the need of some such organization as the "Chicago Plan," which has proved itself a simple, practical method of organization, is absolutely imperative.

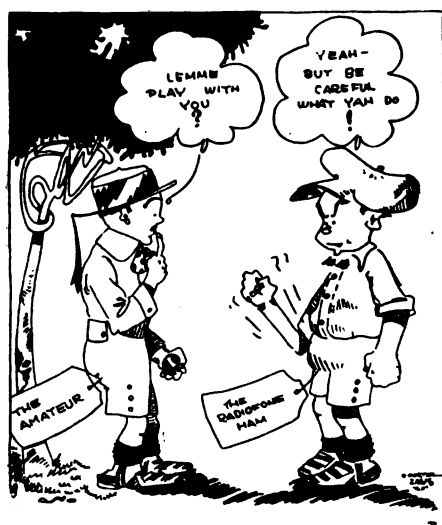
Single large radio clubs intended to co-ordinate all the radio interests of a community have always failed to give the perfect co-operation necessary for the several different classes of radio men to pursue their own lines without interference of one kind or another.

The so-called "Chicago Plan" is merely a method whereby various radio clubs, whether they be school, social or community, may co-operate and regulate radio communication in a truly representative man-

ner. The machinery of this plan, which derives its name from the fact that it originated in Chicago, is extremely simple. Each radio club in the city of Chicago naturally elects its own officers. These officers then automatically become members of the Chicago Executive Radio Council, which body is composed entirely of these officers of the various clubs, six in number in Chicago, together with various officials of the A.R.R.L. Central Division.

This body must *per se* be absolutely impartial in its adoption of regulations since its membership is almost entirely an elected one. No attempt is made by the Council to interfere in any way with the individual activity of the various affiliated clubs but the best of co-operation is secured between them through the friendly personal contact of the officers. Through regulations the dues and fees of all clubs are identical. Any radio man may belong to one or more of the clubs as desired, and meeting dates are arranged so that they do not conflict.

Regulations are drawn covering the time periods allowed different classes of stations to operate. It has been found that three time divisions are necessary, the first for low powered local work only, the second for stations desiring to do long distance work but not wishing to handle message traffic and the third for long distance message traffic only. It has also been found advisable to limit operation so that any one station may transmit during the local and either one of the two long distance periods on any one particular night, but under no circumstances may transmit during both long distance periods on that night.



Puzzle: Which is the new boy in the neighborhood?

Traffic Managers elected by the various clubs carry out and enforce these regulations, each traffic manager having jurisdiction only over the members of his particular club. No attempts are made to enforce the regulations by radio but a log is kept and violators notified either by telephone or mail.

Inasmuch as it is naturally somewhat difficult to impose a fine or penalty on a continued offender it has been found most desirable to divide the city into six districts, apportioning each club one of these districts for which it is responsible. Fines are imposed on the clubs according to the location of violators without regard as to their membership in the clubs. In this way extremely good co-operation has been secured and since these regulations have been in effect for several years the "habit" of compliance has been formed and practically no enforcement is needed at the present time.

With the coming on of radiophone broadcasting the Chicago Executive Radio Coun-

cil at first planned a change in its time schedule to allow a definite period for radiophone listening. By sharp tuning of transmitters, however, the necessity of setting aside a part of the local transmitting period for this purpose has been obviated, and since long distance work is not allowed prior to 10:00 P.M., the beginning of the first long distance period, the low powered local communication is carried on on low waves without appreciable interference to radiophone listeners.

Accordingly, since further regulation was not necessary, the Chicago Council has turned its attention toward taking care of the influx of new radio amateurs or novices who have come into the game because of radiophone interest. It being extremely inadvisable from every standpoint to attempt the discouragement of these new participants in the radio game, a policy of friendly co-operation has been adopted and the Chicago radio clubs, formerly composed entirely of radio relay amateurs, are now rapidly absorbing the new radiophone listeners. This policy has helped both sides materially as the clubs have gained many prominent and influential members who in turn have gained considerably through contact with our "old timers" which have been through the early stages of the game and who have the knowledge that comes only with hard experience.

Since the original adoption of the "Chicago Plan" in the city of its origination, similar plans of organization have been adopted in practically every large city in the country, where they are functioning at the present time. We would heartily recommend to the newcomers in this game of ours a close study of the regulations existing in their localities, bearing in mind that these regulations were drawn up by a majority of the radio men in that locality. If the regulations are not satisfactory to any particular contingent it should be easy to change them so that they can be made fair to all sides as only by adoption and enforcement of absolutely fair regulations can any faction in the radio amateur field hope to succeed.

## Q.S.T. Critics

By L. Q.

ONE Saturday the garage man came in looking rather chewed up. It appeared that the machinist had told him how to grease differentials.

"Was he nasty about it?"

"No I beat him up for not telling me sooner. I'd have beat him up harder if he'd been nasty—but I'd have thanked him just the same."

*Moral*—If the critic knows what he is talking about criticism is always valuable.

# Notes on the Design of Small C. W. Transformers

By Geo. E. Hoke, 9DJU

**S**INCE the comparatively recent advent of amateur continuous wave transmission, there has been a well-nigh insatiable demand for specially designed transformers to meet a large variety of requirements. In the development of new diagrams, small transformers of more or less unusual design are frequently required, which are in most cases unobtainable on the market.

Amateurs are agreed that the results obtained by *designing* an instrument are such that they are well repaid for their trouble in carefully considering a problem before starting actual construction. This is especially true in the case of transformers, since it is impossible for one to guess at the number of turns and the size of the wire and the core and have the completed instrument perform as originally desired.

The purpose of these notes is to furnish sufficient data, in as simplified form as possible, to enable the design of almost any small core type transformer up to one kilowatt or even more. The formulae contained herein are all obtained from standard commercial design data and have been found to be thoroughly reliable. Each formula is simplified as much as possible, so that a minimum of substitution and computation is necessary.

The equations given below are applicable only when 110 volt, 60 cycle supply is used, and transformers designed on this data should be used on no other voltage or frequency, when maximum efficiency is to be obtained and the safety of the instrument duly regarded.

The first things one must know when designing a transformer are the primary voltage and approximate current, and the required secondary voltage and current. This information being at hand, all the specifications necessary for the construction may be obtained quite easily.

In finding the number of turns on the primary and secondary windings, substitute the correct values in the following equations:

$$S_1 = \sqrt{\frac{700,000}{I_1}} \quad S_2 = \frac{110 S_1}{E_2}$$

where  $S_1$  is the number of primary turns

$S_2$  is the number of secondary turns

$E_1$  is the primary voltage on tap

$E_2$  is the secondary voltage required

$I_1$  is the primary current

$I_2$  is the secondary current.

After the number of turns is obtained, it is then necessary to find the size of the wire to be used. This is readily obtained

through the use of the following equations:

Cross-section of Pri. conductor in square inches =  $\frac{I_1}{1000}$

Cross-section of Sec. conductor in square inches =  $\frac{I_2}{1000}$

Of course this does not give the size of the wire, (B. & S.) but the figures obtained are merely substituted in the following table and the size of wire selected which has nearest that same cross-section. For example, if the cross-section is found to be .0011 square inches, the table shows us that #18 B. & S. wire is the nearest size. (A larger size is always selected in preference to a smaller one, in case the figure lies between two values in the table.)

| Size B.&S. | Cross-sect. in square inches | Size B.&S. | Cross-sect. in square inches |
|------------|------------------------------|------------|------------------------------|
| 6          | .02062                       | 19         | .001012                      |
| 7          | .01635                       | 20         | .0008023                     |
| 8          | .01297                       | 21         | .0006363                     |
| 9          | .01028                       | 22         | .0005046                     |
| 10         | .008155                      | 23         | .0004002                     |
| 11         | .006467                      | 24         | .0003173                     |
| 12         | .005129                      | 25         | .0002517                     |
| 13         | .004067                      | 26         | .0001996                     |
| 14         | .003225                      | 27         | .0001583                     |
| 15         | .002558                      | 28         | .0001255                     |
| 16         | .002028                      | 29         | .00009953                    |
| 17         | .001609                      | 30         | .00007894                    |
| 18         | .001276                      |            |                              |

After determining the size of the wire to be used, the cross-section of the core should be computed. This is found by substituting the number of primary turns and the value of the primary current in the equation:

.001865  $I_1 S_1$  inches square. (NOT sq. inches)  
This figure refers to the section obtained by cutting thru the leg of the core at any place.

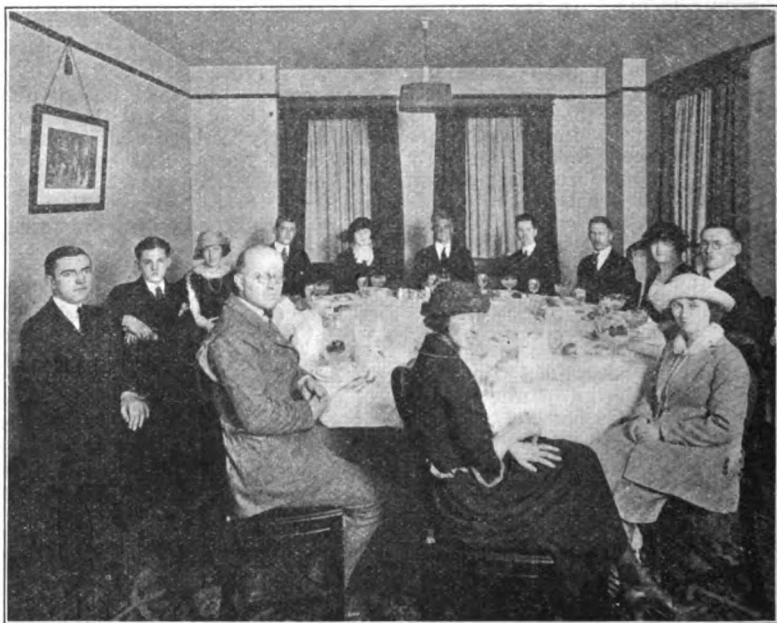
A fixed rule can hardly be given for the size of the "window" of the core, since the insulation used varies so greatly, as does the method of winding. In general, it is satisfactory to establish one dimension, the length of the coils, and wind the coils to fit that particular length, allowing the other dimensions take care of itself.

In designing a transformer for use in lighting the filaments of transmitting tubes, the voltage drop caused by application of the load should not be overlooked. This drop is usually more than expected; hence it is safe to add 15% to the required secondary voltage, thus allowing both for the full-load drop and any possible low feed-line potential.

## Ourselves

**T**HERE is getting to be quite a bunch of us at A.R.R.L. headquarters now, and in the need for greater efficiency we have had to coop up ourselves behind separating partitions so that sometimes days go by without our seeing all of the gang. So just to get a good look at each other we had a little dinner recently at which the above photograph was taken

manager; Miss Margaret M. ("Peg") King, book-keeper and cashier; Hiram Percy Maxim, president of the American Radio Relay League; Mrs. Matilda M. Herrick, stenographer; K. B. Warner, A.R.R.L. secretary and editor of QST; Fred H. Schnell, A.R.R.L. traffic manager; Mrs. Marie C. Seltzer, advertising department; Miss Margaret M. Mays, operating depart-



and which we are reproducing so that QST readers may see what we look like.

In this photograph, left to right regardless of perspective, are David H. Houghton, QST circulation manager; Arthur Lamoureux, files and mail; Mrs. Marjorie A. Foley, circulation department; Robt. L. Northrop, formerly assistant to the secretary; Edwin C. Adams, QST advertising

ment; and Boyd Phelps, assistant editor of QST.

After many reorganizations necessitated by our rapid growth in the past six months, we now have a splendid little gang at Headquarters, and A.R.R.L. members passing thru Hartford are extended a cordial invitation to call on us at 1045 Main St. and look us over.

## Book Review

**S**INCE the rise of popular interest in radio, tons and tons of popular literature have been created on the subject. Books live longer than most other literature and so are the most important additions to the language of our art. Of books there have been many, and it is our purpose here to review briefly a few of them which have come to our attention. There are so many of them, and our time is so limited, that we freely confess that we have not read a one of them from cover to cover, but we believe we have studied them enough to hazard an opinion of their worth.

In view of the present scarcity of white paper it is to be wondered why some of them ever were printed. They are of course of all kinds, good, bad, and indifferent, well illustrated and poorly. Some are really good and some obviously have been written only because there was a chance to cash-in on the tide of radio interest. Fortunately, however, they are not all that way and some instructive and interesting contributions have been made possible to the literature of the art by the assured financial success awaiting any radio publication at this time.

*"Radio Receiving for Beginners"*, by Rhey T. Snodgrass and Victor F. Camp; The Macmillan Company, New York; 99 pages, 4½x6½, \$1.00.

A simple little book designed to answer the question on the lips of thousands of people, "How can I receive radio?" The circuit drawings are good, and well supported by numerous group photographs of actual apparatus. It treats only on receiving apparatus. Well written, and fills the bill.

Mr. Camp, one of the authors, is a director in the A.R.R.L. and so we were not surprised to read in the introduction the advice to the reader to join a local amateur club and get acquainted with amateurs and the A.R.R.L.

*"The Complete Radio Book"*, by Raymond Francis Yates, former editor of "Everyday Engineering Magazine," and Louis Gerard Pacent; The Century Company, N. Y.; 330 pages, 5x7½.

Here by long odds is the most interesting and entertaining of all the new books, and altho we do not know what its price is it is worth whatever they ask for it. As its title indicates, it is told almost in story form and it is certainly easy reading by comparison with the average radio text. In most entertaining fashion the authors tell the tale of the progress of communication from savage days to those of modern civilization. For the first time we read in this book of the early experiments of a certain Dr. Mahlon Loomis, a dentist in Washington, D. C., which certainly form one of the most interesting chapters in the history of radio telegraphy. Back in 1869 and '70 Loomis got signals over a distance of 14 miles between transmitter and receiver using regular aerials and ground connections of the Marconi type. Dr. Loomis did not understand his apparatus and attributed its operation to conduction currents in the upper atmosphere. Indeed it is not known whether actual oscillation and radiation entered into its operation, but if it did he anticipated Marconi by many years.

Reserving the best paragraph for the last to discuss, we find much in this book that one would expect in any publication brought out at this time, but all told in the same story-book fashion that makes it a really good book.

Now to get to that Chapter V. After reading of "radio for everybody", "radio telephony for everyone", "radiophone receiving", and "radio receiving for beginners", it is certainly a grand and glorious feeling to encounter in the present work the chapter headed "Radio as a Hobby." Hooray for some regular fellers! "Radio is the master hobby, it is more than a hobby; it is a malady to which thousands of men

are extremely susceptible." So say the authors, and more than other book writers they have helped maintain amateur radio in its rightful place. With the safe deft style that we admired before we encountered Chapter V, they tell the story of amateur radio, its joys, the clannishness of amateurs, its appeal to the inventive instinct, and the fun of knowing the code. In correcting the erroneous impression that the word "amateur means a person who dabbles with things in a purely unprofessional manner, they tell of our transatlantic tests, and print only a small part of successful operators in the tests with five typographical errors in what few are listed, we forgive them because they did it to help amateur radio. It is in the chapter on "Radio as a Hobby" that the authors introduce their descriptions of various receiving sets. There are eight of these described in detail from a single-slide tuning coil with crystal detector to a three-stage radio frequency amplifier set operating on a loop. Then they discuss transmitters in the same manner, from simple spark coil outfits to continuous wave sets using two 50-watt tubes. The authors have probably foreseen the trend of novice interest and have made their book one that will continue to be in demand by telling how to break into the amateur game. A buzzer practice set is recommended, the reader is told to attend meetings of a wide-awake club and to undertake the immediate learning of the language of the dots and dashes. This book endears itself to us by devoting a whole page to a chart of the good old Continental code, and goes right on to tell the reader what it means to have a good fist and why he must have it, how to get acquainted with the "hams" in his neighborhood, and paints an entrancing picture of the mysterious life of a dyed-in-the-wool amateur. They lead the newcomer right up to the place where he has to have a government call book to find out who the amateur stations are with whom he is communicating, and then gently they introduce him to the American Radio Relay League and advise him to become a member so that he can take part in the interesting relay programs. Our Operating Department is briefly sketched and a typical Operating Department report from the Atlantic Division is reproduced with all its array of call letters, as a word-picture of the happy little world in which we real amateurs live.

A chapter on "Who's Who" gives little biographical sketches on many of the notables in commercial radio, and the book concludes with a chapter of "Questions and Answers" gleaned by one of the authors while serving as radio editor on one of the New York newspapers.

(Concluded on page 49)

## The New Radio Bill

THE long-awaited radio bill has now made its appearance as an outgrowth of the Department of Commerce's Radio Telephony Conference and was introduced in the Senate by Senator Kellogg on June 8th and given the number S.3694; while the identical text was introduced in the House on June 9th by Mr. White of Maine under the number H.R.11964. In the Senate the bill was referred to the Committee on Interstate Commerce and in the House it went to our old friends the Committee on the Merchant Marine and Fisheries. At this writing no further action has been taken and no dates have been announced for hearings. The text of the bill now being in hand, arrangements are being made as we write these lines for an early meeting of our A.R.R.L. Board of Direction to study the bill and determine the League attitude thereto.

We are printing the complete text for the information of A.R.R.L. members and suggest that everyone read it over carefully. Get out your copy of the 1912 law and compare the two. Notice that this bill does not repeal the old law *in toto* but amends it, principally by substituting new Sections 1, 2 and 3. It is for the most part the work of Congressman Wallace H. White, who was himself a member of Secretary Hoover's conference, and shows deep and intelligent study of the radio problem.

The general idea of the bill is that the law shall not specify wave lengths or classes of stations or any other technical consideration but instead shall give almost unlimited authority to the Secretary of Commerce to classify stations, license them, and make, alter and revoke regulations respecting their service, location, wave length, decrement, range, power, operating hours, etc., with authority to refuse or revoke a license whenever it is in the public interest to do so. It is an open secret that at present the Department of Commerce has no option but to issue a broadcasting license to every aspirant that asks for it, regardless of the chaos certain to result. The situation at present is entirely out of hand and confusion reigns supreme on the broadcast air. Everyone knows that this condition must not be permitted to continue and it is the primary purpose of the proposed revision of law to give the necessary authority to the Department. The axe, the pruning shears and the wouff-hong will then be in evidence, or we miss our guess.

But the main concern of our A.R.R.L. must be the effect the proposed measures will have on the amateur. At the hearings we asked for definition of our status in the law, and Mr. Hoover's Commission unanimously recommended that the status of

the amateur and his wave length bands be defined in the law. *This has not been done in the present bills.* It is true that Regulation Fifteenth of Sec. 4 of the old law is to be amended to the effect that no private station shall use a wave length more than 275 meters nor less than 150 meters but it takes quite a stretch of the imagination to construe that as a definite grant of those wave lengths to us amateurs. Nor is our existence given any guarantee in the bill—we are not named as one of the classes which shall always be provided for, as we asked. Until our Board meets on the matter we do not feel that there is more that we can say on the subject at this time.

Perhaps the next most important feature is the matter of fees for examinations and licenses, covered by Section 9. The fees are small and will be no burden on the amateur, and as the revenue obtained thereby will result in a directly-improved inspection service, we believe everyone will favor the idea. We have talked over the matter with many amateurs and found none opposed to it, while on the other hand it was voluntarily suggested by several of the amateurs testifying at the earlier hearings.

The third paragraph of Article C of Sec. 2 is frankly a trust-busting clause and we suppose there'll be a merry little scrap over it. Personally, we hope it sticks. Then in Sec. 4 is an interesting proviso making permits necessary before the start of construction of all save government and private stations. This seems a most wise provision: it will save money for some folks by stopping the erection of undesirable broadcasting stations before they get started.

It should be noted carefully in Par. F of Sec. 2 that the license of any station, including amateurs, may be revoked for violation of any regulation, and that the Department will have power to make almost any kind of regulations, including an assignment of operating hours. That means that if it ever became desirable "in the public interest" for amateur transmission to be prohibited between sunset and sunrise the way is indicated legally. It is provided, however, that hearings shall be held first; and off-hand we consider that sufficient safe-guard, as we think revocation of licenses should be possible when in the public interest. This paragraph will mean the knell for some alleged broadcasting stations.

We shall have more to say about the bill soon.

—K.B.W.

(Text of Bill on page 56)



# EDITORIALS

## de AMERICAN RADIO RELAY LEAGUE



### Flattening Out

**P**OPULAR broadcast radio has been in violent collision with the well-known "summer slump" and has come down like the equally proverbial "ton o' bricks". There have been many contributing factors but the most important one, of course, is the call of the out-doors. Radio fans, intrigued by the fascinations of getting broadcasts out of the air rather than loving radio for its own attractions as a hobby, cannot be expected to maintain interest in these hot days. And the radio column-conductors have discovered that wireless doesn't work so well in summer—that there are peculiar noises known as static which often are fearfully distressing. And the combination of single-circuit tuners, temperaments unused to sticking at the game on hot evenings, and ears that can't weed out static, was too much. The wonderful radio boom has come down kerplunk—for the summer at least.

It happened in middle May, fully two weeks sooner than the cautious dealers had anticipated. At the present time Mr. Novice has almost stopped buying and who do you suppose is doing the purchasing? The stores tell us that their sales now are almost altogether to amateurs—the amateurs keep on spending.

With the smash-up a great deal of the inflation that has been apparent in the radio sales field has gone down. Cancellations of equipment orders with the manufacturers have been as huge and as rapid as the original orders. It seems that in most towns where there were say a hundred potential sales and ten dealers, every one of the ten dealers had his order placed for the hundred sets; and with the sudden cessation in novice purchasing and the uncertainty of what conditions would be like in the fall, the cancellations placed by the dealers in that little town totalled a thousand! Much of the "big business" is therefore seen to have been largely fictitious and the wind is suddenly out of the sails of many a hastily-launched radio enterprise.

Amongst the countless radio dealers and jobbers speculation is rife as to "the future of broadcasting". We are glad to see that it is realized that the programs are not good enough to hold interest and

that something must be done to improve them. The big question is to determine how they are to be supported financially. It seems probable that some organization of the merchandizing end of radio will be brought about to co-operatively maintain a few properly-operated broadcasting stations which will put out programs of real merit. And there are others who believe that the widespread broadcasts of entertainment are merely a transient phenomenon incident to the introduction of modern radio to the general public and that in short order it will find its rightful place not so much as a medium for entertainment but more for the dissemination of information of that sort that which has a national value and may more properly be maintained as a public service at public expense. At any rate we believe we can foresee the early revision of broadcasting methods and programs, with resultant improvement of what is now a very distressing condition in the ether.

And now for a most important sign of the time. *The public is beginning to want to learn the code!* The average broadcast listener gets a tummy-full of the mush on 360 meters in an average of three weeks and commences to look around for something interesting. The once-despised code has shown its fascination, exactly as we believed it would. On every hand the novice listeners are awakening to an interest in the continental-pushers and are actually engaged in mastering the dots and dashes. They're on the right track, art., for there is the thrill and there the sesame to the joys of DX.

All these little signs point towards a big improvement in radio—less padding in the business, a better-behaved ether in the vicinity of 360 meters, and the awakening of amateur interest on the part of Mr. Fan. Which bring us to a most vital topic. Read on:

### Holding Our Own

**I**N recent months when broadcast reception was the rage and hundreds of thousands of people were getting up a wire in the air and lustily laying the blame for everything that interfered with their concerts on the heads of us poor amateurs, we pointed out that the time had come when

we should share the air; that we no longer could have all the night to ourselves but should recognize the rights of the listeners to have quiet for part of the evening, and we counselled a voluntary division of operating hours as determined by local sentiment.

This was well and good and we know that it is still the proper thing. But many of us have gone to the other extreme on the rebound and amateur traffic is suffering. Many of us seem to be giving up the air altogether to the broadcast listener and this is not fair. He doesn't rate it. We stand for a just and fair distribution of hours, but that means that some of the hours belong to us. We know just what the feeling is: we know that when we start up at ten o'clock or ten thirty there are still many listeners in our community fishing around for broadcasts and they wish we would keep quiet. They wish it so hard, and often so volubly, that frequently we do, particularly when traffic is light. But are we then being fair to our own game? No. We are entitled to part of the evening, and after long consideration your headquarters office is of the opinion that it should advise you that you should feel perfectly free to make use of it. It has got so bad that some of us are actually afraid to touch our keys. *This must not be.* Amateur relay traffic must continue. Why, we know some fellows who more than once have been telephoned as late as one o'clock in the morning by novice listeners with an impatient request to QRT while they listened to a broadcast. If it's just an ordinary broadcast, the answer is that they've already had their inning, and if it's some special DX broadcast they're copying then they are practising the amateur DX game with the rest of us and running the chance of traffic QRM, and our attitude should be the usual A.R.R.L. attitude—always ready to QRX a bit for a fellow ham who's trying for a record but certainly not giving up the ghost and relinquishing our rights entirely for the other chap.

A little backbone, fellows! A worm will turn, you know. Now be careful that there is no radical stuff, no shouting, no wild-eyed explosions. But we telegraphing amateurs are doing a more important work than all the broadcast listeners in the country and we are entitled to a place in the ether. See that the broadcast listener gets the lion's share of the evening in which to listen and when that time is passed, *hop to it!* The air belongs to us then, and altho we are perfectly willing to share it with anyone who meets us as a fellow-amateur we do get peeved at being insulted because we try to unload the old hook at 10:45 while Mr. Cady K. Aay delivers a soul-stirring address on "Why Pittsburgh is a Beautiful City."

At the present writing broadcast reception is at the lowest ebb since its beginning, and now is our time. We must step in now, even tho it means difficult work thru summer QRN, and quietly take our rightful place in the ether. And then, when the listeners descend upon the air in the fall, *hold it.*

We want to see amateur relay traffic starting up with a bang in the later hours of the evening. QRV, OM, QRQ!

## A New "Chicago Plan"

**A**LTHOUGH the proposed changes in the radio regulations prepared by the Electrical Committee of the National Fire Protection Association were intended only to be submitted for expression from the interested public and to be applied by inspectors in limited cases merely to obtain field experience, there is protest from many quarters that they are already being observed with all the force of law and complaint is made of the autocratic application of these proposals by local inspectors.

It seems to us that the preliminary proposals of the code committee are being abused. In Chicago in particular a city ordinance is proposed which would provide that every receiving and transmitting station must be licensed by the city, receiving stations paying a fee of \$3.00 and transmitting stations a fee of \$5.00, with a charge of \$1.50 for every re-inspection. The basis for all of the installation provisions of the ordinance is the tentative report of the electrical code committee above referred to. This Chicago ordinance would be a joke if it were not so serious a matter. It purports to be desirable because of the hazards to life and property that in the popular imagination exist in improperly-insulated receiving sets, so it provides that aerials and actual apparatus can not be installed until a permit is obtained and that they cannot be operated until an actual license is obtained after the paying of the fee. Now get this: no change in the apparatus, of however insignificant a nature, can be made until permission is granted, and it may not then be operated again until re-inspected at an additional dollar and a half, *except that the aerial may be changed in any desired manner* as long as it complies with the specification of the underwriters' code, and *no permit or re-inspection is necessary*; it is simply required that a notice of what is done be filed with the proper authority.

This is nonsense. If there be any conceivable danger in the possession of a radio receiving set it is the possibility of the antenna being struck by lightning, accumulating a static charge, or coming into contact with power wires. A law that in the

(Concluded on page 58)



# INTERNATIONAL Amateur Radio

## An Echo of the Transatlantic Tests

The Editor of QST is the proud owner of the gorgeous top-piece illustrated in the photograph on this page. Thereby hangs a most interesting tale:



In an issue of QST in the early summer of 1921, in discussing the results of the first and unsuccessful transatlantic test in February of that year, we made the statement editorially that the British amateurs could hardly be expected to show the same ability in receiving short wave signals as an American dyed-in-the-wool ham who had learned how to get amateur DX only after years of patient struggle, and we stated we were willing to bet our new spring hat that if a good U. S. amateur with American equipment and an Armstrong Super could be sent to England, reception of U. S. amateurs would straight'way become commonplace. This statement was reproduced in the English "Wireless World" and caused considerable commotion in British amateur

circles. When the announcement was made of a second Transatlantic Test, and that the A.R.R.L. was sending Paul Godley, its picked amateur, overseas with American equipment to endeavor to get signals, the British amateurs had their chance, and Mr. M. W. Burnham, of the firm of Burnham & Co., prominent British manufacturers of British apparatus, took up our bet of the "new spring hat"—he bet us that Godley would hear no American amateur signals.

Radio history was written, of course, with those tests, and although the British amateurs were equally as successful as Mr. Godley, the bet of the new spring hat still stood. Mr. Burnham promptly cabled "Congratulations. Cable size of hat," and the result is the special "lid" of our photograph.



Paul Godley almost played a dirty trick on us. We had a letter from Mr. Burnham stating that Mr. Godley had told him that the proper style of hat to send us would be a brown derby, as that was the kind we always wore! The only thing that prevented that from occurring and

making it necessary for us to go down and punch Godley's nose was that Burnham's hatter was unable to learn what kind of a hat a "derby" might be and so had to get up something special for the occasion. (For some queer reason they call 'em bowlers over there.) In accordance with our promise made in an incautious moment, we also present our own photograph with the hat on—which is, of course, another work of art.

The hat, which was made by Harrod's, is handpainted in colors, bearing on one side the Union Jack and on the other the Stars and Stripes, united by wireless flashes which encircle the crown. Inside the hat is the inscription "From W. Witt Burnham, M.I.R.E., to Kenneth B. Warner, Secretary, A.R.R.L.", while on the front in hand-painted lettering is "In Commemoration of the Success of the Anglo-American Wireless Test organized by the A.R.R.L., 1921."

We must express our great admiration for the beautiful way in which Mr. Burnham "came through." We thank you, sir, and send cordial greetings to the British amateurs you typify. While the hat is hardly one which we would feel safe in wearing to church on Sunday morning, it is nevertheless our intent to wear it on official A.R.R.L. occasions. It fits perfectly; thank you—our normal head size having been given you in spite of the temporary swelling that existed immediately after the success of the test.

Now who wants to bet us something about a cut-away coat?

#### French Amateur Licenses

The licenses of French amateur stations permit the use of up to 100 watts in the antenna and a wave length of 200 meters. There is a fee for the license of Fr. 100 per annum. The stations are licensed for scientific research and transmission tests, but correspondence on personal or contemporary affairs is prohibited under the general license. It is in this latter classification that American amateur radio falls—rag-cheewing and relaying—and if a French amateur wants to carry on such communication he must name his correspondents with whom he wishes to communicate paying an additional fee per annum of Fr. 45 for each kilometer between his station and each corresponding station.

At which rate it would cost an American amateur about a million dollars a year!

#### French Short-Wave Work

A recent issue of the French magazine "La T.S.F. Moderne" displays considerable interest in short-wave reception. It is realized that interest in short-wave transmission is waking up in France but there are as yet but few to listen to the trans-

missions and information is desired by their amateurs on short wave reception.

They draw a lesson from the European reception of the recent A.R.R.L. transatlantic tests and while realizing the difficulties of short-wave radio frequency amplification, they point out that the four best British receiving stations used high frequency amplification, which they contrast with standard American practice of a regenerative detector with two steps of audio amplification.

The receiving equipment of Mr. Deloy, French 8AB, is described. Although he has heard no American stations this year, on Dec. 16th in the transatlantic tests, at 12:30 o'clock he heard unmistakably the word "test" on 200 meters, spark, very QSA, good fist, the station's signature containing the figure 1 and he believes the letters "O" and "S". Mr. Deloy's aerial is an umbrella of three wires, 25 meters long and 20 meters high. He uses an American-built Tuska tuner, with variometer plate tuning for regeneration, American Baldwin phones and a French detector with three step audio amplifier. The operation of U. S. amateur equipment is relatively easy for Mr. Deloy as he is "part American," having been a member of the French Radio Telegraphic Mission in the United States during the European war.

#### Reinartz Tuner in England

The first five pages of the May 15th issue of "The Wireless World & Radio Review," England's leading radio periodical, are devoted to a description with working drawings of a Reinartz tuner, by Mr. Percy W. Harris. The author describes his reaction upon reading the statements we made about the Reinartz tuner in QST and "decided to construct the tuner for himself so as to test the certainly remarkable claims made for it. The result of his test convinces him that many other British amateurs will be glad of particulars and constructional details, as the tuner is of great interest apart from the claims justly made for it."

We were greatly relieved to find that the British amateur seconded our estimate of the Reinartz tuner for C.W. reception. We were a little afraid that so staid an experimenter as a British amateur might accuse us of exaggeration and over-optimism and find a whole lot of things the matter with it, but Mr. Harris seconds our comments and adds a few goods ones to it.

In Mr. Harris' tuner, instead of the customary Reinartz spider-web, a conventional cylindrical coil on a  $3\frac{1}{2}$ " tube is used with the same excellent results.

"Frogs, Limies, Spicks, Wops and Yanks"

We have begun to wonder what we amateurs of different languages will do when

international amateur radio becomes an accomplished fact. For example, what will American IBGF think about the line of stuff he copies from French SAB? And if an amateur in Sweden attempts to give some Atlantic coast amateur a message for his sister in Minneapolis, who is going to know what to do with it?

Very naturally, then, we have drifted into a consideration of an international language and with many of us that means Esperanto. We would like to know what readers of QST think of the feasibility of this, and we would like to hear from amateurs in foreign countries in particular. Are the difficulties of international amateur communication such as to make it desirable that amateurs adopt some such international language? Can it be grasped sufficiently in the time an average amateur could devote to it, to make it a feasible thing? Is such a language capable of handling our technical terms with understanding? Esperanto has many opponents and it has some competitors—for example, who can tell us anything about Idiom Neutral?

#### On the Hum in England

The British amateurs are now showing considerable backbone in their endeavor to get greater freedom of operation and are considerably "on their ear" towards the Postmaster General. Almost all of the clubs over there are connected with a central organization and their affiliated strength is appreciable. They are handling their negotiations in a high-grade, diplomatic manner, of course, but it is very evident that they now mean business.

#### Lid Lifting in England

On page 40 of QST for June we told of representations made by British amateurs to their Postoffice Department looking toward an extension of their privileges. Just as we go to press with this issue word is received from England that the Postmaster-General, after consultation with other government departments concerned, has agreed to the following modifications:

The restriction that transmission must be confined to five other stations will be withdrawn, on the understanding that the matter transmitted will be confined to communications relating to the experiment in hand and intended solely for the stations actually co-operating in those experiments. The broadcasting of general calls, news, or advertisements, or of matter similar to that which will be transmitted from the proposed broadcasting stations, will be expressly forbidden.

Transmission will be permitted for an aggregate maximum of two hours in each twenty-four hours, provided that no transmission shall commence without previous listening-in on the wave length which is to

be used in order to ascertain whether the proposed transmission is likely to interfere with any other station which may be working, and provided that no single transmission shall last more than ten consecutive minutes; and each transmission shall be followed by a period of not less than three minutes listening-in on the wave length used for transmission.

New wave lengths are allotted: 150 meters to 200 meters inclusive for spark, C.W., and telephony; 440 meters for C.W. and telephony only; and the fixed wave length of 1000 meters has been withdrawn.

Our congratulations, British amateurs! This is a recognition that six months ago would not have been thought possible. It is a big stepping stone in the advance of amateur radio and undoubtedly will hasten the day when European and American amateurs will work across the sea.

What amateur news from other foreign countries, you QST readers?

—K. B. W.

#### Amateur Radio in Porto Rico

*By E. C. Stephens*

Now that the Dear Old Static Season is about to return upon us, and we read and hear about such remarkable results going on all around us, The Trans-Atlantics, with QSA Hawaii pounding in on one tube; it just makes some of us fellows that are around the brim of the bowl of activity sit up and scratch an ear.

There is another small island a sister to the Philippine and Hawaiian groups, not quite so far away, Porto Rico, about half way from the U.S.A. on the route to the South American northern coast, between four and five hundred miles from the nearest A.R.R.L. station and even less than that from the Coast of Venezuela or other South American republics.

Now, during the last four or five years, and shortly before the World War began, a certain few studious young native men became interested in Radio. The pioneer and leader of them all was Sr. Joaquin Agusty, whose station was described in a late issue of QST. He had been interested in radio for some time and had built considerable apparatus at home, but had never seen a real commercial radio installation until he made a chance visit to a small inter-island steamer which was placed in the island service about a year before the World War drew the United States into action. Of course during the war he was restricted, doing little or nothing except studying intensely. The result was that when the amateur restrictions were raised he was ready with an up-to-date receiving apparatus. The operators of the different steamship lines were gotten acquainted with, which promoted more interest, and the ship operators were helpful with advice

as to design and the results from different types of apparatus. The first amateur license in Porto Rico was granted to Mr. Agusty, 4JE. Owing to being within about one mile of the San Juan Naval Radio Station, he is forced to use the prescribed reduction of power, or five hundred watts. He is using sixty cycle non-synchronous, on two hundred meters, and is heard all over the island with a radiation of two and a half amperes. By the time this reaches the main-land, he may have a fifty watt C.W. transmitter in operation. Tuning and adjusting are under way at present.

Don Juan is the instigator of a real amateur radio club, known as the "Porto Rico Radio Club", Box 868, San Juan, P.R. He has been elected president also. With the advent of the Club, we have about a dozen other licensed amateur stations on the Island, including Jesus T. Pinero, (4KT); Jose M. Maduro, (4KS); Alberto P. Graham, (4JV); and Enrique Comunas, (4LG), who are all officers of the Club.

One of the features of the Club is a concise course of instruction in radio principles, which is being distributed without charge to all members. The lessons are given under the correspondence school plan, the member receiving a few pages of theory with a set of questions to be answered, which are returned to the President of the Club, who corrects them and assists the member in understanding them thoroughly. Instruction in the construction of practical apparatus is also a strong feature of the course, as is co-operative buying of radio apparatus. The club is also planning the erection of a more efficient station outside the five mile circle from the San Juan Naval Station, where they can use the full allotment of power granted to all amateurs. Due to this island being quite mountainous, we have an abundance of water power, which makes electric current reasonable in price.

Of course most all of you have heard NZR, a U. S. Naval station designed and built during the World War, in the very heart of the Island. The site selected is in the center of an extinct volcanic crater, which is several miles across. NZR, an arc station, gives us plenty of practice both in receiving and in the elimination of harmonics. It is one of the connecting links of the United States and her possessions. Another radio station is also boasted by the Island, Ensenada (WPR), on the southeastern end of the Island, a privately-owned five kilowatt, fifteen hundred meter installation. This station being spark offers the beginner with a crystal an opportunity to pick up a little code now and then.

The first amateur radio phone station was installed by Jesus T. Pinero, who lives towards the interior of the Island, among mountains and high altitudes. His generous use of the instrument has caused

considerable interest in the mysterious art, and he is daily drawing others into the field which is comparatively new in this country.

As to our plans—during the summer months we are going to use our vacations to advantage; the club installation must be in readiness for the A.R.R.L. work next winter. We are all going to be there with some kind of a set, but most popular of all of course is C.W. our hopes are based on the creation of intense interest among the younger generation of our near neighbors in South America. We believe we can induce them to make some kind of an effort to come to the front in radio, put up a station or two, and give us Citizen Radio traffic for the U.S.A. And may our American brothers get into the spirit with us and work towards the same goal as they did during the "Trans-Atlantics"! We are in the game, too. Americans, every one of us. Give us the same support you are giving Trans-Continental, "Trans-Atlantics" and Trans-Pacific; we are with you!

During those world-famous tests we were sitting tight down here, in the land of Senoritas, Static, and Sombreroes, the Magnavox was squeaking, 1BCG was calling also 1ARY and 1AFV. Our range includes several "four" stations, particularly 4GL, with "eights" and "nines" all coming in very QSA. The question of static is always present in these latitudes, but we have our winter just the same as you, altho of course it is never cold here. The air is clear and cool, and our nights are very comfortable even in the mid-summer months. The south-east trade winds are constantly blowing, giving us a very even temperature. During the summer months QRN increases considerably, but we do not experience it any stronger than you do in forty to forty-five degrees north latitude. Another odd feature, we have severe and intense static from shortly after sunset until about two hours before dawn, altho during the day we experience little or no interference from it. It also seems that the nearer you are to the equator the less static you have on long wave-lengths while short waves seem to be unworkable because of the continuous grind. This is the reverse in the northern hemisphere. However, during the months of November, December, January and February we have very favorable results for real "DX" work.

Another point of interest to the Island amateur is the establishment of a radio store in San Juan. They have installed a radio receiver of standard make, where, with the aid of the Magnavox, they are able to give interesting concerts and radio lectures in our native tongue, Spanish. We are really the first real foreign amateurs to enter the field. We speak English

(Concluded on page 63)

# The Operating Department

F. H. SCHNELL, Traffic Manager  
1045 Main St., Hartford, Conn.



**A**T this writing the Traffic Manager is making a tour of the Western Coast and the Secretary presents the Operating Department report in his absence.

The effect of summer weather is very noticeable in the report for May—in fact perhaps more noticeable than it will be when we become used to hot weather and to straining our ears to hear signals through static. It is perhaps only logical that with the coming of pretty weather

thrill of the great out-doors is wearing away we may expect the summer gang to get steadily on the air with increasing results in their traffic figures.

\*\*\*\*\*  
\* L. G. WINDOM, 8ZO \*  
\* Columbus, Ohio \*  
\* 330 messages \*  
\* Central Division \*  
\*\*\*\*\*

The extended practice of daylight oper-

## Message Traffic Report By Divisions

MAY, 1922

| Division                | C.W.       |             |           | SPARK     |             |           | TOTAL      |             |           |
|-------------------------|------------|-------------|-----------|-----------|-------------|-----------|------------|-------------|-----------|
|                         | Stns.      | Mgs.        | M.P.S.    | Stns.     | Mgs.        | M.P.S.    | Stns.      | Mgs.        | M.P.S.    |
| Central                 | 13         | 367         | 28        | 10        | 1174        | 117       | 23         | 1541        | 67        |
| Dakota                  | 15         | 548         | 37        | 10        | 409         | 41        | 25         | 957         | 38        |
| Delta                   | 6          | 169         | 28        | 3         | 119         | 40        | 9          | 283         | 32        |
| East Gulf               | 10         | 410         | 41        | 4         | 145         | 36        | 14         | 555         | 40        |
| New England             | 12         | 437         | 36        | 9         | 553         | 61        | 21         | 990         | 47        |
| Northwestern            | 5          | 75          | 15        | 13        | 544         | 42        | 18         | 619         | 34        |
| Ontario                 | 5          | 115         | 23        | —         | —           | —         | 5          | 115         | 23        |
| Pacific                 | 11         | 599         | 55        | 20        | 1036        | 52        | 31         | 1635        | 53        |
| Roanoke                 | 24         | 490         | 20        | 7         | 120         | 17        | 31         | 610         | 20        |
| West Gulf               | —          | —           | —         | 8         | 209         | 26        | 8          | 209         | 26        |
| Winnipeg                | 1          | 3           | 3         | —         | —           | —         | 1          | 3           | 3         |
| <b>Total</b>            | <b>102</b> | <b>3213</b> | <b>31</b> | <b>84</b> | <b>4309</b> | <b>51</b> | <b>186</b> | <b>7522</b> | <b>40</b> |
| Total Spark, 4309—57.3% |            |             |           |           |             |           |            |             |           |
| Total C.W., 3213—42.7%  |            |             |           |           |             |           |            |             |           |

No traffic reports from Atlantic, Midwest, Rocky Mountain, Vancouver, Quebec or Maritime Divisions.

there should be a temporary interest in outdoor things that prevents the making of reports and the handling of a greater volume of traffic. Thus we have no reports at all this month from the Atlantic, Rocky Mountain, and Maritime Divisions, and incomplete or wholly lacking traffic reports from several other divisions, the result being that our traffic report shows fewer messages handled, fewer stations participating, and a lower average of messages per station than any previous month this year.

It is very obvious, however, that this is not due to the fact that relaying has dropped off decidedly but simply due to failure on the part of the stations to report their traffic. Now that the first

ation is the greatest single improvement that can be made in summer operation. It should be borne in mind that stations within daylight communication range can handle traffic even better in daylight because of the lessened atmospheric, often working with ease when communication would be entirely out of the question after sundown. C.W. is likewise making great improvement in operation, and it is particularly interesting to note in this month's reports that southern C.W. stations are moving traffic in a territory that has been completely isolated during the summer heretofore because of continuous strays.

Traffic honors for the month go to the Central Division, and a spark at that.



Although obviously only a small percentage of our May traffic has been reported to this office, the figures actually reported are as follows:

Northwestern Division—C.W.: 7ZU, 31; 7QE, 27; 7QB, 10; 7BS, 7; total 75. Spark: 7OT, 137; 7BK, 108; 7VZ, 101; 7LY, 46; 7HI, 38; 7WM, 26; 7BG, 25; 7NC, 24; 7AJ, 16; 7FR, 12; 7HQ, 4; 7MH, 4; 7ON, 3; total, 544.

Delta Division—C.W.: 5WO, 55; 5EK, 28; 5LJ, 28; 5KU, 28; 5LA, 20; 5HB, 10; total 169. Spark: 5DA, 63; 5MO, 28; 5RZ, 28; total, 119.

Ontario Division—C.W.: 9AL, 44; 3DS, 26; 3UZ, 16; 3JK, 15; 3JL, 14; total, 115.

New England Division—C.W.: 1ASF, 100; 1ADL, 79; 1BKQ, 54; 1QP, 49; 1PR, 45; 1UJ, 27; 1BYG, 22; 1CBJ, 22; 1AWB, 21; 1HX, 7; 1CK, 6; 1BIK, 5; total, 437. Spark: 1RX, 150; 1LZ, 106; 1BOQ, 77; 1BYG, 48; 1CNI, 46; 1DY, 42; 1CAJ, 32; 1WQ, 30; 1CK, 22; total, 553.

Roanoke Division—C.W.: 3IW, 72; 3BLF, 71; 3CHO, 55; 3ZZ, 37; 3RF, 31; 3BPU, 30; 4GH, 27; 4DC, 25; 3BIJ, 23; 3BKE, 21; 3CA, 19; 4GX, 18; 8AUE, 18; 3BZ, 16; 3BHL, 14; 3AEV, 13; 8AMD, 13; 3ATZ, 9; 8AVW, 9; 3ACZ, 7; 4EN, 5; 3TJ, 4; 3BVB, 2; 3BNM, 1; total 490. Spark: 3ACK, 28; 4CCX, 26; 3AOV, 25; 8BAZ, 17; 3CHO, 17; 3BVC, 5; 8AUE, 2; total, 120.

West Gulf Division—C.W.: Oklahoma Stns., 4. Spark: 5PE, 137; Oklahoma Stns., 40; 5MK, 21; 5OI, 8; 5UP, 3; total, 209.

Central Division—C.W.: 8EA, 58; 3ABO, 50; 8ZZ, 44; 8BO, 42; 8AM, 41; 8UY, 40; 8BLW, 30; 8JZ, 15; 8AND, 14; 8BLT, 12; 8AGG, 9; 9BLC, 9; 8AQC, 3; total, 367. Spark: 8ZO, 330; 8FT, 305; 8BBU, 257; 8UC, 162; 8EA, 41; 8AUU, 24; 9YB, 22; 9GU, 20; 8AND, 7; 8EB, 6; total, 1174.

Winnipeg Division—C.W.: 4CB, 3.

East Gulf Division—C.W.: 4BF, 130; 4GL, 71; 4BY, 61; 4CO, 40; 4IZ, 40; 4II, 20; 4EH, 15; 4CG, 15; 4YA, 13; 4JR, 5; total, 410. Spark: 4BI, 80; 4HS, 30; 4EZ, 25; 4GM, 10; total, 145.

Dakota Division—C.W.: 9WU, 170; Minneapolis Stns., 83; 9BBF, 80; 9YAJ, 60; 9QF, 50; 9YF, 30; 9AGN, 20; 9AEJ, 25; 9PI, 18; 9BAF, 10; 9TI, 8; 9AIF, 5; 9DAF, 4; 9BAV, 3; 9EA, 2; total, 543. Spark: 9AIG, 127; Minneapolis Stns., 119; 9BRI, 4; 9BOF, 24; 9AVZ, 22; 9DOC, 20; 9AGN, 20; 9BFP, 16; 9AIF, 10; 9LW, 10; total, 40.

Pacific Division—C.W.: 6ZZ, 204; 6CU, 150; 6KA, 61; 6EN, 39; 6ASV, 31; 6ZX, 30; 6JD-6ZG, 26; 6AGH, 18; 6ALU, 14; 6AK, 14; 6FT, 12; total, 599. Spark: 6AJH, 140; 6GT, 120; 6AS, 118; 6IB, 109; 6AJR, 100; 6LC-6HY, 76; 6ZD, 69; 6HP, 6; 6OD, 46; 6BDZ, 45; 6ZZ, 33; 6OM, 26; 6AFP, 22; 6AAH, 22; 6GI, 15; 6ABX, 11; 6GS, 9; 6ZC, 6; 6ASV, 3; 6YB, 2; total 1036.

## CENTRAL DIVISION

R. H. G. Mathews, Mgr.

Although the Division Manager has had excellent co-operation from some of the newly appointed Assistant Division Managers during May. In a few instances no action has been taken and no reports sent in. This little announcement is intended as informal notice that unless better and more prompt co-operation is secured during the coming month some changes will be made.

## INDIANA

Mr. M. W. Hutchison, A.D.M. for Northern Indiana reports things opening up in fine shape this month and though none of the District Superintendents have sent in any message reports they are getting their relay routes into working order and by next month everything will be running smoothly. He is very well pleased with the way the new Superintendents have taken up the work. J. Ralston Miller, Superintendent of District #2, has sent in a very complete report and has started things going in great shape. Most of the fellows in his district have been off the air for some time and are just now getting back on the job. Ames, 9DTJ, of Francesville, has a new tube set and is getting out from the first to the seventh district. He will aid in getting traffic through Northwestern Indiana for his location is excellent. 9BAT is installing a CW set and will be ready to handle traffic soon. 9CP, Hammond, has been out of commission for some time but will be back on the air in the near future. Both CW and spark will be used at 9CP. Messages for Southern Indiana go through Crown Point to either 9FS at Goshen, or to 9DTJ at Francesville. Messages east-bound go through 9FS and consequently both southern and eastern routes are in working order. Mr. E. E. Pippenger, Superintendent of District #1, Goshen, does not have his routes fully lined up as so reports very little excepting the fact that he anticipates no difficulty in lining up his stations soon.

F. S. Libbe, 9AKD, has been reappointed City Manager of South Bend. Mr. Libbe works on CW and is doing exceptionally good work. L. S. Slagle, 9ME, has been reappointed City Manager of Fort Wayne. No word from 9DAX but he continues good work with C.W.

## MICHIGAN

Mr. C. E. Darr, Assistant Division Manager for Michigan, reports as follows: The light traffic this month can be accounted for locally by the menace of the broadcasting done locally. We have three high-powered stations and they are continually going from nine in the morning until eleven at night. The only ones that are doing anything are the ones that stay up all



light. FB-HI! Static conditions are very bad and have been for a month. The District Superintendents are working hard and are doing excellent work in the various districts. This week we will have appointed City Managers for Port Huron and Saginaw. Then we will next get after the Official Relay Stations. We are also organizing a special emergency route with pre-arranged schedules in case there is a tie up in all telegraph lines as has happened often through storms, etc. Each station on this route will be obliged to stand a 24 hour watch and will be manned to be 100% efficient during any emergency.

### OHIO

Mrs. C. Cander, Assistant Division Manager for Ohio, reports that to date only three of the newly appointed District Superintendents have sent their acceptance of appointment, P. A. Marsal, District #3; L. E. Furrow, District #4 and R. D. McCommon, District #6. P. A. Marsal reports that he will soon forward a list of men which he recommends for City Managers for his district. L. E. Furrow reports that he is getting in touch with the various cities and towns in his district with a view to making his selection for Official Relay Stations and City Manager. He is also assisting to organize the radio club in Dayton. The Xenia Radio Club is being revived and now is backed by the Chamber of Commerce.

Prof. R. V. Achatz, City Manager of Lafayette, Indiana, reports business is falling off as usual with the coming of the summer season. 9YB was out of commission about 10 days due to aerial tower failure. They now have a new 100' cage about 90' above ground, but have not really had a good test to see what it will do.

### NEW ENGLAND DIVISION

P. F. Robinson, Mgr.

1BKQ, the Worcester County Radio Ass'n., wants it to be noised around that they are on 190 meters. If anyone wants proof let them tune down and listen to the noise they make there. On the way down (1) stop at 200 and listen for 1BRQ's new 100 watt C.W. set.

1ASF wants the address of the manufacturer of ohm-removers. He has 64 in his antenna that don't agree with his new C.W. set at all.

1PR, Boston College, is proving to be a good central station for traffic. They are QSO, daylight, all parts of New England from 1ARY north to 1AZW south. They are using 3-50 watt tubes on 1400 volts D.C. and radiate about 5 amps.

1CK had a fire in his shack and is out of commission for a few weeks.

### ROANOKE DIVISION

W. T. Gravely, Mgr.

Reorganization of the division is now practically completed. The fellows are lining up with a spirit that means much for the Division's future. For the first time we are now fully organized and running smooth.

Reports from every point show that listeners are turning to code work and evincing interest in relay matters. The relay men of the division are helping and encouraging them and a promising crop of DX men is looked forward to. A club is being formed in southwest Virginia. Those interested please write to D. C. Culbert at Marion, Virginia. Danville has a newly organized club which is going good, especially on code work.

8BKE is working big DX, being reported by 7JS Anacortes, Wash. 8PU gets the traffic honors in W. Va. with 30, 4GH in North Carolina with 27, and 3IW for Virginia and the Division with 72, with 3BLF shoving him with 71. F. B. all around. Despite static and listeners, traffic is holding up very well. 3ATZ, 3ACZ, 3BVB, 3ZZ C.W. and 3ACK, 3ACE, 3BVC on spark are keeping the ball rolling about Portsmouth with more good stations coming up. 3CA and 4EN are moving to new locations and will be out about a month. The usual remodelling and fixing up done at this season is going on. 8CAY at Elkins and 8AMD at Lewisburg have hooked up for daylight work. When 8AMD connects with 3CA or 3RF the entire division will be open north and south and also east and west for DAYLIGHT work. A dream come true.

Nearly all District Superintendents are slow sending in reports to their A.D.M.'s. Fellows, this is important so please come across by the 20th. We need the help, we can't report what you fellows don't.

### DELTA DIVISION

Hubert E. deBen, Assistant Mgr.

Severe static during the past month reduced traffic work considerably throughout the division. The work that was done was accomplished by piercing the heavy blanket of QRN which covers this part of the country from April to October every year. Brother S. Kruse is in New Orleans attempting to eliminate static with Hammond's idea and when said Bro. Kruse proclaims that southern QRN is "rotten stuff" to the nth power, we just know it is.

### LOUISIANA

QRN keeping the traffic total low. Interest still high, however. The Pullen Bros. 5ZAB of Houma, considered the best Louisiana station, are remodeling their station and promise an ether-wrecker for next

season. City Manager Manard of New Orleans reports things going slow in the relay line. 5HB has shown considerable activity of late and put over a clump of messages. 5LA did very excellent work handling 20 in spite of severe interference from the QRN and concert broadcasting stations.

#### WINNIPEG DIVISION

J. A. Gjelhaug, Mgr.

J. E. Maynard, 4CB, Dist. Supt. of Saskatchewan, reports very little long distance or relay work done during last month, on account of bad QRN on prairies, only once in a while a night that they can work stations of any distance.

4BV, Loreburn, got his 10 W. C.W. going strong, but now has tube trouble and like every one else is waiting for repairs. He has been heard nearly all over Western Canada and U. S. 4BR of Regina got going fine, with 30 W. tube, but tube soon blew up. 4EI of Moose Jaw with spark coil 5W. I.C.W. going fine around Province. 4AO, Walter Pottle, Moose Jaw, has been on the sick list for some time, but now better and again on air, but unable to pierce QRN very far with his spark. H. N. Stenen, of Stenen, Sask., no doubt has best receiving set in the Province and with spark coil set keeps in regular touch with 4BV. He promises a good, strong C.W. transmitter by fall. 4CB, J. E. Maynard, Morse, Sask. is off the air for about two months, completely rebuilding his station and moving to better location.

Moose Jaw has two live radio associations, Senior and Junior, with more amateur stations than any other point; both associations have sent in applications for affiliation with the A.R.R.L. What Moose Jaw needs now is a good strong transmitter to connect up with the outside world. The Senior Assn. is trying to get such a station under way.

Regina recently organized a live radio association and we understand the old organization at Saskatoon is going strong again. Lajord has a live club.

So far, 4BV and 4CB are the only stations to reach stations of much distance, and until 4CB is rebuilt please route all messages for Saskatchewan to 4BV.

Mr. T. W. Brown, 214 C. P. R. Bldg., Saskatoon, Sask., has purchased 4CB's complete transmitter and should be going strong long before this is in print. Anyone hearing his C.W. or fone, please drop him a card.

We are not getting the co-operation from outside points in regards to news and traffic we would like. Come on, fellows, and drop your Dist. Supt. a line before the twentieth of the month.

Saskatchewan is talking strong of a radio convention this summer.

Thirteen broadcasting stations are under construction or going now in Western Canada, some of them 2KW. By fall the air will be full of music and news.

#### VANCOUVER DIVISION

Wm. D. Wood, Jr., Mgr.

The month of May has been full of local activities in and around the city of Vancouver, but the amount of "DX" work has dropped off to almost nothing. The chief event of importance was our unsuccessful test with 5AX in Prince Rupert, B. C.

Mr. Barnsley in the farthest north Canadian city has been hearing Canadian 4CB, 5AK, 5CN, 5DO and 9RD with regularity and the D.M. encouraged him to get all the transmitting apparatus in P.R. together and put up one real sending outfit. The result was a half K.W. and a quarter K.W. Thordarson hitched in parallel and the usual glass plate condensers and non-sink rotary gap. This outfit put out 3 hot wire amps, according to 5AX, but all through the three day tests we were unable to hear it in Vancouver. QRN is fierce in Vancouver now and we have not squelched all of the local squeek boxes that delight in sending from a book after "DX" hours for their code practice.

5AK, 5CN, 5DO and 9BD all worth south to the sevens in Washington and Oregon, but very little traffic has been handled of late.

The Radio Inspector, Mr. Howard, has opened permanent offices in the P. O. Bldg., Vancouver. All mainland amateurs are expected to take their exams here while those on Vancouver Island may apply at the Division Superintendent's offices in the Old P. O. Bldg., Victoria.

The B. C. Radio Association is now handling local traffic with their new Ellwood  $\frac{1}{4}$  K.W. spark set which was installed about the middle of the month at the club's headquarters.

The D.M. has had but very little correspondence with amateurs in Alberta and Saskatchewan for he does not know who have the best stations in that territory. All reports from these two provinces regarding their local conditions would be appreciated if sent in to the Manager.

#### MISSISSIPPI

Bay St. Louis: 5ZAU is gradually rounding into shape and will soon make an attempt to handle traffic.

#### TENNESSEE

W. C. Hutcheson, Supt., reports traffic off during the month due to severe static conditions. However, some of the relay stations managed to handle a few messages. Considerable interest is shown throughout the district in the receiving end. A large number of receiving stations were installed for listening to the broadcasting stations and no doubt a great many will

develop into transmitting stations in the future.

Interest in Chattanooga seems to have dropped off due mainly to static and a great deal of delay in obtaining material and equipment. 5LU and 5HL have been very quiet. 5AAG is building a new shack and hopes to be going again soon. There are two new stations going up, one CW and one spark. The City Manager has not been able to raise any one outside of the city limits with his 20 watt C.W. so has placed an order for a complete 100 watt set and hopes to do some relay work as soon as it is installed.

5DO in Memphis has handled some traffic on his 20 watt C.W. set. 5LJ has just finished his 50 watt C.W. set and is getting out in fine shape. 5EK is on every night with his 25 watt set. 5KU is now using a new 100 watt set and is getting out fine. 5MO and 5RZ are doing good work with their spare sets. In spite of heavy QRN 140 messages were handled by the several stations in Memphis. 5DA had been pulling off his usual startling stunts. On only a few nights during the month and handled 63 thru the heaviest of QRN.

5WO was the only active station in Knoxville during the month and succeeded in handling 55 messages. 5UU is still out of commission and will be for some time. 5ABM is getting into working condition and is reaching out very well. 5WS, the City Manager station, is inactive waiting for a motor-generator set.

#### ARKANSAS

Activities decreased to a considerable extent during the past month because of heavy QRN. 5UE, 5CB, 5ABY, 5SP and 5JB are keeping the traffic moving throughout the state. 5CB has been doing notable DX work with his 10-watt C.W. set in spite of the QRN. 5JF has also been doing good work with his spark set. 5ZL and 5JD have started to rebuild and won't be on for some time. Things are lined up so that when the good weather sets in the traffic will shoot through at high speed.

#### PACIFIC DIVISION

*J. V. Wise, Mgr.*

#### SOUTHERN SECTION (ARIZONA)

*J. F. Gray, Asst. Mgr.*

#### DISTRICT A

All relay stations are closing down for the summer; terrific QRN makes work in the southwest impracticable after May 1st, and nothing more can be done till October. No more traffic must be routed via the Southern Trunk Line. 6ZZ leads the District with 204 CW and 33 spark. 6ZDH is second with 69, all spark working regular schedule with 6HY west and 5XD east. Concert receivers are popularizing radio enormously.

#### DISTRICT B

6AJH leads with 140 messages; 6GT is second with 120. Summer QRN on the Coast is not too bad to prevent the route north remaining open. The District Superintendent wishes to state again that the A. R. R. L. is solidly behind the Pacific Plan, and that no traffic will be handled with stations that do not adhere to it. The appointment of Dr. L. E. Waters as City Manager for Anaheim-Santa Anna is announced; we look to him to put traffic handling in this section on a businesslike basis. W. R. Dodson has been named City Manager for Riverside. Eastern traffic must not be routed through District B during the summer.

#### DISTRICT C

H. A. Duvall, 6EN, late acting superintendent, is appointed Superintendent, replacing 6ZN, who found he could not spare the great amount of time this position requires. 6CU heads the District for a second time with 150 CW messages; 6LC-6HY, staunch and able supporters of the spark, are second with 76. The eastern route via Denver will be maintained all summer by 6EN, 6KA and other high power CW. City Manager appointments are as follows: Los Angeles-Hollywood, C. F. Filkstead, 6CU; Pasadena, Alhambra and suburbs, D. Gardner, 6OD; Long Beach, H. Brown, 6ALP; Pomona, D. H. Kest, 6AGP; Santa Barbara, A. B. Lopez, 6AAK.

#### DISTRICT D

The only stations working here are 6ZS and 6ZF. The latter has taken traffic direct from Honolulu, 6ZAC. The old dream of a relay to the Islands is now a fact. 6ZAC has a 100 watt set that is heard along the entire Pacific Coast. 6ZF and 6ZS are both tube equipment.

#### DISTRICT E

A total of 523 messages handled by six spark stations here this month. Routes north and south are in perfect working order. Little traffic handled from Santa Cruz to Bay Cities. Power troubles have hampered 6VX and 6TU the last month, but things will be patched over some time in May. 6IB shows a busy month; his long suite is with 9BD, Vancouver, B. C. fine biz. 6IB also worked 5CN, 7NN, 7JD, 7MP and 7FR.

#### DISTRICTS F & G

The Bay Cities. 6ZQ, spark, 6ZAF, C.W. and 6BZI C.W. have been successful in working 6ZAC. The wave used by all is 375 meters. 6ZQ is C.W. and spark equipment, the spark a 500 cycle quenched set. 6AOR, 6AS, 6EX, 6HP, 6ASJ C.W., 6AWT C.W., and 600 C.W. have been keeping the north, local, and south routes open and clear every night.

#### DISTRICTS H & I

Every night finds our old Sacramento spark stations on the job, 6GF, 6GR, and

6FH. All three are excellent outfits, and stay on the air night after night. By the way, all three are now proud owners of a fifty watt tube each. Sacramento will be a C.W. city yet. 6UC is again on the air full swing with a splendid spark set. 6TC is gathering dope on C.W. now and it looks as though another spark may quit. 6AK and 6ZX, both C.W. 20 watts, are doing good DX work as well as clearing the bay on schedule.

#### DISTRICT J

6AJR has handled practically every thing this last month for Reno, Nev. He has also kept open the route from the two borders via the east side of the Sierra range. The route east via the Central route is closed.

#### ALASKAN DIVISION

Roy Anderson, Mgr.

Our friend of last summer, 7BJ from Vancouver, is back in Chignik. He reports that a Reinartz tuner is being used and that, on the way up, many 9's were heard. Also 6ZAC of Hawaii. The "CEDAR" (Ketchikan) reports 6ZAC and a bunch of 7's as well as the nightly P.I. (Seattle) concert.

Due to induction QRM, positive verification of the following is not possible. It is, however, with reasonable certainty of reception that the following calls are given from 7IT:

May 1: 7WN, 7AT, 7NN, 9BD (Canadian), 6XAD. May 3: 7YS and CL-8. May 5: 7OT clg 6AJR, on one step. 7GE on one step. 7FI on detector only. 6AJR clg 7OT on detector only. 6EN on one step. May 6: 6ZZ and 7FR. As 7IT is located 660 miles from Seattle, all of the amateurs heard are at least that far away, excepting Vancouver 9BD.

As Chignik is more than a thousand miles from the states, all amateurs heard by Mr. Sturley will be around 1200 miles away.

#### NORTHWESTERN DIVISION

H. F. Mason, Mgr.

The usual summer weather is here, bringing with it the static and the disappearance of many stations from the air. This leaves it to the old standbys and those not affected by the weather to stay on and put the traffic through. Everything is going fine and dandy, except that we sure would like to see about ten A-1 stations spring up throughout the division and enable traffic to be handled by the short-jump method, with its greater reliability.

Stations in Oregon are especially urged to kick through with those message reports.

#### MONTANA

Credit for the most consistent work during the past month goes to 7VZ at Libby. He reports that had he been able to clear east oftener, more traffic yet could have been handled. 7ZU handled some traffic

on voice, and the rest on CW this month. He had the misfortune to have his antenna blow down recently, so will be off the air for a while. 7DJ has little to say, as there are no new stations and very little traffic is being handled. However, there are still hopes. At the A.D.M.'s station in Bozeman the static has been unbearable most of the time, and only on a few nights was it possible to do any DX work. The reorganization of the state is progressing and it looks as though there would be definite results within a few weeks.

#### IDAHO

7JF, 7OT, 7WG, and 7YA are taking an active part in relaying, and are doing good work. Clyde Anderson, 7JF, has been appointed D.S. for Northern Idaho. He reports, however, very few stations thruout the state. 7OT at Boise has been moving traffic in big chunks during the past month, and deserves credit.

#### OREGON

Seaside, has been very good for the handling of relay traffic, according to A. A. Thibodo, D.S. 7HD hooked up with Canadian 5CN, and 7VZ and 7BK during the forepart of the month. 7HD will have two operators during the summer months. 7KE reports the static worse at Myrtle Point. 7RC is reaching out on half KW spark. 7CW has been heard several times lately. We are sure glad to see him back in the game, as he has a good station, and is a real operator.

The Salem Club is running a very interesting traffic contest for stations whose power is not over a quarter KW and will award a prize to the winner. The object of the contest is to encourage stations with small powers, to handle relay traffic.

7TJ senior, who is the father of our 7TJ, well known for his DX work last winter, is using the same set, but signing 7AEQ. Down at Albany, 7LR is installing 50 watts of CW.

At Vancouver, 7ZK and CL8 are doing DX but are not handling much traffic. Portland: 7DP on CW and 7ED on spark are the only ones doing much. All of the old timers are busy manufacturing sets now, and are off the air.

#### WASHINGTON

A.D.M. Weingarten reports as follows: Seattle traffic is being handled with regularity by 7BK, 7BS, 7FR, 7NC and 7QB. 7BK has two operators and is standing regular watches. 7FR has installed a sink gap, and is reaching out in fine shape, working both east and south. 7BS and 7QB are holding down the CW end of the game. In Tacoma, 7AJ, 7BG, 7QE, 7WM are handling traffic. The loss of 7BC is still strongly felt, as he was one of the old reliables. A number of sparks are contemplating changing to CW. In eastern Washington 7GE continues his consistent work. 7FI is on strong at times, but is

still hunting for a condenser to hold down that coffin. Everything seems dead around Spokane. Messages for the east can be handled by 7HI to 7VZ very well. In the Grays Harbor district, 7KJ, 7NW, 7NN and 7SC are taking everything that comes their way, and one of them is on every night.

Greater interest in "code work" is being shown thruout the division by our "dear listeners" and it is predicted that before fall there will be more stations on the air than ever before.

### ONTARIO DIVISION

A. H. K. Russell, Mgr.

May has been decidedly slow in regard to relaying, and, as usual, the Districts are very delinquent in reporting, so that this report is somewhat brief.

Brantford is very seldom heard from now, and the same applies to Guelph and Galt. The only ray of light in Western Ontario at present seems to be 8GX at Linden, Ont., some short distance from Brantford, who has purchased 8WO's spark transmitter and is doing very fine DX work but has sent no report of messages, which we hope to receive from him next month. Kitchener and Waterloo have formed a Kitchener & Waterloo Radio Club with 15 charter members. 3DS in Kitchener has started out with DX work at last, using 50 watt C.W. and 25 cycle synk gap, handling 26 messages on C.W. 3SB and 3TY (ex 3QJ) not running.

Toronto is now practically entirely C.W. and no reports have been received of relay work by spark transmitters. 8CZ has been trying to qualify for a boiled owl, messages C.W. 16. 8JI and 8JK have kept up their good work with 14 and 15 messages, respectively, on their small C.W. sets, and 9AL has handled 44 on C.W.

No reports received from other Districts.

### EAST GULF DIVISION

Reported by R. H. McMillan, Traffic Asst.

Well, fellows, here it is. If you expect to get a report into QST you will have to send in a report to us as we are not mind readers.

We wish to congratulate Ass't Div. Mgr. Harrod on the work he is doing in Florida. If we had one or two more assistants like him we would probably maintain our average throughout the summer.

The Savannah fellows are to be complimented for the spirit they show. Supt. Hodge mailed in his report from a hospital in Savannah where he is lying on his back recuperating from an operation. Supt. Hight is also in the hospital in Rome recuperating from an operation and reports that 4BQ has been inactive this month; but promises to burn things up with the new 500 watt C.W. set that he completed

just before he went to the hospital. On an initial dalite test he worked 4CO in Atlanta, handing him traffic at 11 A.M.

### FLORIDA

M. F. Harrod, Asst. Div. Mgr.

This state must stand by now, for that blanket-like tropical static, ever pounding in the phones, is here for the next few months and must isolate us from the efficient relays that we established during the past winter. No one is idle, tho, for we are striving with the end in view of having this state more fully equipped to handle all msgs. that need go from it or come to it, in the fall. In Pensacola, St. Augustine, Winter Park, Lake Monroe, and other towns we have not heard from in the past winter, we are going to have good DX stations by fall.

1st District, M. D. Clark, Supt., reports in Jacksonville 4ZE, 4BP, and 4FS, are inactive due to this ever-hammering static. 4EZ, spark, is still at it, and reports 25 msgs. We are pleased to announce that "Shorty" 4EZ is going to have a CW soon to show his spark up. The Times-Union in Jax has a 20 watt CW, and will maintain two ops on watch, as soon as license is obtained. With the addition of the CW stations that are now in the process of building in this Dist. it will be more and more efficient as time progresses.

2nd Dist., E. R. Hall, Supt., reports four CW stations in process of building in St. Petersburg, and prays they will be ready by fall. 4BF has sold his 500 w. set to the Tampa Times. He has assembled a 50 watt set which is handling traffic between 4BF and near-by Naval Stations, when the big 5 KW spark set fails to carry. Msgs.—130. In Tampa, 4IZ, CW, 40 msgs. Orlando, 4II, CW, 20 msgs.

Dist. 3, F. M. Bookwalter, Supt., advises as the only good thing about this district that can be shown this month is the formation of a radio club in West Palm Beach, which will be invited to affiliate at once. 4IH in Boca Ratone, with an Amrad set, will be in communication with WPB in good WX. Supt. Bookwalter says that if there are any AMATEURS left, when the static leaves us, he will be able to do some REAL work, for he is improving the old set a lot.

4th Dist., W. E. Woods, Supt. Miami—Nothing doing account of static. Several stations are figuring on CW, but none actually READY yet. In Homestead, Seymore Dan will have a CW set by fall.

### GEORGIA STATE REPORT

W. B. Pope, Ass't Div. Manager

Savannah: Supt. Hodge reports 4GL and 4BY copied steady by ship operator from New York City to English Coast. This is fine work for summer weather. Message traffic is comparatively nil compared to the preceding months, 4GI only 71 and 4BY 61. We can excuse 4BY since he has been in the hospital most of the

month but we cannot imagine what has happened to "Old Efficiency".

Atlanta: A new club consisting of all the old amateurs of the city has been formed to control interference that existed between the broadcast listeners and the DX men of the city. 4BI has been doing the only consistent DX work of the city. Practically every night he is in reliable communication with all northern and eastern points of the country. 4HS and 4GM are also doing excellent work on their gravel grinders. 4FT will be on next month with his CW using the call 4ZB. Few other CW sts. going now, however. Most of them are either remodeling or building entirely new sets.

#### WEST GULF DIVISION F. M. Corlett, Mgr.

#### SOUTHERN TEXAS SECTION *Alfred P. Daniel, A.D.M.*

Dist. Supt. Ed Nettleton, 5ZN, at Eagle Pass, Texas, reports his district to be considerably mixed up, having been visited by several tornados recently and considerable damage resulting. All stations in Laredo were put out of commission and those remaining are suffering from constant QRN. Asst. Dist. Supt. Wall at San Antonio writes a similar story regarding weather conditions, almost continuous storms and atmospheric disturbances in that vicinity, and that together with practically every local station dismantled and changing over to CW, almost no traffic has moved. 5ZAK and GP4 have consolidated and will hereafter operate from Kelly Field. Thad Perry and Joe Tyler have consolidated and will answer to the call of 5ACU. 5XI has been signing DM4 while operating huge army fone set at Kelly Field. This station is soon to be moved to a more favorable location. Mr. Joseph L. Tyler of 1025 S. Presa St., San Antonio, has been selected by the local Radio Club to fill the vacancy of A.R.R.L. City Manager.

South Central Texas, too, has suffered from storms according to Dist. Supt. Tilley's report, Austin having had quite a cyclone, but no one lost his antenna system. 5XX has opened up with a splendid fone set and has already covered 1200 miles. 5PD recently moved from Waco to Austin and is creating quite a bit of envy with his bright and shiny copper tubing OT. Wonder if it can be used for any other purpose. Hi. Austin loses one of their best stations with the removal of 5ABZ with his 4— $\frac{1}{2}$  TC amps on  $\frac{1}{2}$  KW, who goes to San Antonio to live. Kee of San Marcos is putting in fine CW set to match up with his already splendid masts and aerial. Sahm at New Braunfels expects to get a rest from shot condensers now that his brand new CW and fone set is nearing completion. 5XU has climbed out of the amateur class as it were, be-

cause of his 2 KW spark and fone set. They are now broadcasting crop and market reports and weather bulletins under the call of WCM.

South East Texas district is no exception to the hard-hit and almost constantly interrupted radio activities due to storms and twisters. 5NK and 5ZO lost the top sections of their masts in a recent blow. 5ZW has been isolated for weeks in the Brazos flood district and has been depending on Houston stations to keep his family posted as to the probable duration of the flood. He has been passing the time away by fishing from his front porch, and tells of a catch of a three footer. All streams in Texas have been on 40 to 50 foot rises.

The new stations in the air are 5KM, C. Porter Sweeny at Angleton, Texas, who has remained silent during his senior year at school. 5ACF is a new Houston station owned by A. W. Pollard and is the utmost in CW. 5FA at College Station has developed into 5ZP. 5XB has been almost entirely silent for sometime, and no report from our good friend Doc this month. 5XB will remain open all summer during the intensive radio course which that institution has provided. The Houston Radio Club is growing to such proportions that new and larger quarters had to be arranged for. Many novices who are interested in receiving broadcasts are joining in order to learn more about the game. Practically every well known local amateur has a position with some local radio supply house and several are doing installation and operation of broadcasting stations at several points in the state.

#### OKLAHOMA SECTION *Maurice L. Prescott, A.D.M.*

Demon static seemingly has set his foot on our section for the summer, but he is finding it hard to keep a bunch of our energetic "hams" away from their sets. Activity and interest is being shown in all districts and we just have a "hunch" that when four or five 50 watt C.W. stations which are now under construction are completed they will pound right thru QRN and enable us to keep up our relay work with nearby 9's and 5's. And, also, how about interdistrict communication in our own State? Give your A.D.M., D.S. or some of the other fellows a call and let's see if we can't connect; something that has, as yet, never been done to any marked degree.

5BM, Selby of Muskogee is getting results out of his new 50 watt C.W. He says one 50 watt is all you need to get real DX.

No new transmitting stations have been reported this month. 5HK, 5ZM, 5ZG, and 5LO are all rebuilding or installing new equipment altogether. 5LO has sold his spark to the School of Mines located at Miami. He is putting in a C.W. now. 5FO is no more; Prescott is now 5ZG and in addition to the old spark a new C.W. on 375

meters will be installed. 5PU, 5ZZ and others of that section have been giving very consistant service.

### DAKOTA DIVISION N. H. Jensen, Mgr.

Traffic in this Division has naturally dropped off somewhat due to bad atmospheric condition, but it is gratifying to note that there is more activity this summer and that more traffic is being handled than there was in the corresponding period last year. C.W. stations, of course, must be given credit for this to a great extent.

Northern Minnesota. The jumps in this District are really too long for consistent work during the QRN period. However, several daylight routes have been established and schedules have been worked out. A number of new stations are springing up and the prospects are very bright for good work in this District in the near future. The stations most active are: 9EA, 9BAF, 9ADF, 9ZC, and 9BAV. Three broadcasting stations in Duluth keep the air fairly well supplied with QRM.

North Dakota. Active stations include 9LW, 9AEJ, 9AGN, 9WU and 9DOC. Some trouble is noted by DX stations in being unable to tune their receivers below 250 meters. This District Superintendent suggests that all stations test and find out just how low their receivers will tune. Where Remler variometers are used, it may be found necessary to take off all but 19 turns on each side of both stator and rotor in order to get down to about 200 or 190 meters. This was done at 9WU after the same trouble had been experienced. Traffic in this District has been going thru 9WU as follows: West, 9WD, 7WG, 9XAAQ, 9ZAF, 7ZU and 7WH; East, 9XI, 9AUP, 9AJA, 9AIY, 8BO, 8VY, 8WR and 8BKE. 9WU's spark set with a record of 3400 miles has been bought by 9YF, the Mayville Normal School.

South Dakota. The stations that are on the air regularly in this District are as follows: 9BRI, 9AVZ, 9AIG, 9AIF, 9BOF, 9PI, 9ASF and 9TI. Daylight routes are being worked out and schedules arranged. Charles Norton (9AIF) has been appointed Dist. Supt.

The newly appointed Division Manager is more than pleased with the splendid co-operation given him by all stations, and his only regret is that he hasn't the time to keep in touch with all of the stations.

The following new appointments have been named in this Division:

E. S. Leavenworth, Ellendale, N. D., Asst. Manager.

J. A. Gjelhaug, Baudette, Minn., Asst. Manager.

Edgar W. Freeman, Elk Point, S. D., Asst. Manager.

Charles T. Norton, 521 West 11th Street, Sioux Falls, S. D., Dist. Supt. for South Dakota.

William D. Wagner, 123 West 4th St., Duluth, Minn., Dist. Supt. for Northern Minn.

Thomas W. Jackson, College Heights, Jamestown, No. Dakota, Dist. Supt. for No. Dakota.

James E. S. Hayes, 705 E. 5th Street, Duluth, Minn., City Manager of Duluth.

Alvin H. Rosvold, 423 No. 3rd Street, Aberdeen, So. Dakota, City Manager of Aberdeen.

E. W. McQuillen, 701 So. 7th Street, Brainerd, City Manager of Brainerd.

### MIDWEST DIVISION L. A. Benson, Mgr.

Due to the great interest in broadcasting and further QRN, traffic in the Midwest Division has taken a slump. Only two reports from Asst. Division Mgrs. have been received. Several St. Louis stations are still on the job handling traffic: 9DMJ, 9BED, 9AFC, 9ZB.

### MISSOURI DISTRICT G. S. Turner, A.D.M.

The District Superintendent of Western Missouri is the only one who sent in a report this month. The other fellows were heard from but no reports were forthcoming. McDaniels at Columbia is very busy arranging for the All-State Convention that is to be held at Columbia May 30 for the purpose of organizing our state into an All-State Radio Club. Dr. Klenk, Dist. Supt. of Eastern Mo., says radio concerts are killing traffic down there. Traffic is moving, but so little of it that it is not worth mentioning. The fellows are already interested in perfecting their receiving sets for the coming winter. Almost the only real active interest that is shown in St. Louis now is in their radio club and in the big proposed state organization.

As soon as our state is organized we shall have to express our rights as amateurs who are interested in all phases of the game and not in hogging the air with broadcasting as numerous stations of high power here in Missouri are now doing. Schedules shall have to be instituted or the first thing we know our name will be "Dennis"—in other words we will no longer exist as a body of amateurs interested in the development of radio from a scientific standpoint but rather a gang of individuals working toward no common end. Then because we are divided and unorganized, adverse legislation will quickly take advantage of this condition and legislate our once world-renowned transmitting stations out of existence. Yep, fellows, it's a pessimistic picture but unless something is done it is going to be a reality before we know it.

Traffic has practically been at a standstill in Kansas City this month due to the almost continual QRN. Very few messages have been handled and then over only short distances. 9RR has been getting out fairly well on spark, working practically all C.W. stations. The radio club in K. C. is attempting to line up the local broadcasting stations to get a little order out of the chaos now existing. Two new 500 watt commercial sets will be opening up in a few days and when they do "goodness knows" what will happen. It is the desire of the radio club to have at least two silent nights here. The City Club of Kansas City is back of this idea and we expect something to happen shortly.

Radio 9FM is developing a real he-size radio station; when it is remembered what good relay work he did with his old station great things are surely expected from him this coming season.

Less interest than usual has been shown in relay work in St. Joseph lately. 9EX has his two 50 watters hooked up but hasn't been on much as yet. 9ANO has been on quite a bit in daytime lately but for some reason has been unable to handle but little traffic. 9DRW has been reaching out some with his 1KW spark but has no traffic to report. Interest is being kept alive in the radio club and much is expected of it this summer.

### NEBRASKA DISTRICT

*John G. O'Rourke, A.D.M.*

Traffic during the past month has been moving in all directions exceedingly well considering the increasing QRM. And I must state that it not been altogether due to the CW stations. In fact, in but one instance has traffic been handled consistently by CW in this district. For the entire district 9HG, 9ASO, 9DSM, and 9DNC have headed the list in traffic work. These men deserve credit for their efforts, inasmuch as they do not receive co-operation from the other stations. 9HG, Griffith, Omaha, reports working consistently with 9DKK, 9DNC, and 5QS. 9ASO is also DXing and clears a large amount of traffic. Mr. Platner, 9DSM, CW, is the one CW stations in the district that has reported handling traffic. 9IF of Giltner is operating a CW station and is working several districts consistently. Palmer of Lincoln seem to be the one Lincoln station in consistent operation. You Lincoln fellows please wake up and get in your report.

One traffic appointment has been made by the Asst. Division Mgr., Paul Palmer, 9DNC is now Asst. District Supt. under Mr. Anderson and has control of all traffic work in the neighborhood of Lincoln.

Fellows, I am going to ask again what I have asked innumerable times, and that is, please send in a report if you want credit for your work: We are not mind

readers, and if you desire to enter into traffic work write at once to either the Asst. Division Mgr., J. G. O'Rourke, 3064 South 32nd St., Omaha, or the District Sup't, Mr. Ed. Anderson, 308 North 27th Ave., Omaha. We must have some sort of co-operation if we are to place the Nebraska district at the top of the Division's list. Now let's go. This applies especially to stations in the western portion of the state.

I wish to point out to the broadcast fans of this district the fact that when receiving a certain broadcast station's 235 meter "harmonic" on a single circuit receiver they are not immune from spark interference. Remember the spark man is not always to blame. Nine times out of ten it's your receiver, or your neighbors. The radio relay has a perfect right to the air providing he is within the law, and with few exceptions the spark man is. In the future please hunt a higher "harmonic" when listening to local broadcasts. I believe the amateur operator will play the game fifty-fifty with you.

I am expecting to hear from you fellows next month so that we may re-instate the old Nebraska relay routes for the static season at least.

### BOOK REVIEW

*(Continued from page 31)*

It is certainly a pleasure to run unexpectedly into a story on our A.R.R.L. in this book. We like the "Complete Radio Book" better than other of the new-comers and think it is well worth anyone's while.

"Radio Telephony for Everyone", by Laurence M. Cockaday, technical editor "Popular Radio" and "The Modulator"; Frederick A. Stokes Company, New York; 213 pages, 5x7", \$1.50.

Here is a book by an old-time amateur, and it reflects more of the amateur atmosphere and more of the amateur's method of attacking a problem than any of the newer books that have come to our attention. As stated in its preface it is written in "every-man's language" with the sole idea of dispelling the shroud of mystery surrounding radio in the layman's mind. The chapters in turn treat of simple electron theory and wave theory, and then leaps nimbly into a discussion of the vacuum tube as an electron generator of waves (certainly a commentary on present day essentials—contrast it with the practice a few years ago of introducing at about this place in the story open antenna oscillators excited by a spark coil, Hertzian oscillators, etc.); modulation, aeriels, tuning, detector, regeneration, the building of a small phone transmitter, the construction of receiving sets, and the care and maintenance of apparatus.

*(Concluded on page 58)*



# Who's Who in AMATEUR WIRELESS



**HOWARD F. MASON**

The Manager of our Northwestern Division was born in Marion, Indiana, in 1901, and moved to Seattle when four years old but says he didn't see any DX stations on the way out. He got started in earnest in 1915 and heard his first signal at 7:14 P.M. Saturday, September 4th (extract from log). On learning the code the signals were identified as KPA, a 5 KW station 5 miles away. The following year a transmitter was installed and operated under the call 7ML until closed down during the war. The half kilowatt was unable to work anybody over fifteen miles away 'tho the same transformer now does 1000 miles and has a 1,550 mile record.

In March 1917 he went to sea as an operator and stuck to this for two years and a half. Since the war he has been operating 7BK and holds the record in his

*(Continued on page 63)*



**M. F. HARROD**

This young son of Marconi, formerly 8VS and now 4II, was born on June 20, 1902, in Toledo, Ohio. At the age of six he moved with honorable parents to New London, Ohio, and soon decided electricity was the only thing to follow.

Starting this greatest of all games—radio—in 1919, he went thru all the conventional stages of the loose coupler and crystal followed by an audion, vario-coupler, and spark coil, thus mastering the mystery of the mystic dots and dashes. From October 1920 until June 1921 old 8VS in Toledo tried to show the world that Ohio was on the map. With his five watt C.W. set and an antenna current of eight-tenths of an ampere he was heard over half the U. S. and worked 900 miles to 9OE. These were the days when power tubes had to be "snitched." 8VS was on

*(Concluded on page 69)*



**T**HE A.R.R.L. has the honor of announcing the affiliation of the following additional societies as of May 26, 1922:

Franklin Radio Club, Bronx, N. Y.; Benson Radio Club, Brooklyn, N. Y.; The Endicott Radio Association, Endicott, N. Y.; I Tappa Key Radio Club, Harrison, N. Y.; Thor Radio Club, Burlington, N. J.; Jefferson County Radio Club, Watertown, N. Y.; The Clifton Radio Club, Clifton, N. J.; Plainfield Radio Association, Plainfield, N. J.; Passaic Radio Council, Passaic, N. J.; Olean Radio Club, Olean, N. Y.; Lake Shore Radio Association, Jamestown, N. Y.; Clayton Radio Club, Clayton, N. Y.; Minersville Amateur Radio Association, Minersville, Pa.; Radio Club of the City of Ithaca, Ithaca, N. Y.; Cazenovia Radio Club, Cazenovia, N. Y.; Vandergrift Radio Club, Vandergrift, Pa.; Greenpoint Radio Association, Brooklyn, N. Y.; Nutley Radio Club, Nutley, N. J.; Westfield Radio Association, Westfield, N. J.; Port Washington Radio Club, Port Washington, N. Y.; Beaver Valley Radio Club, Rochester, Pa.; Poughkeepsie Radio Association, Poughkeepsie, N. Y.; West Philadelphia Radio Association, West Phila., Pa.; Cooperstown Radio Association, Cooperstown, N. Y.; Belmar Radio Club, Belmar, N. J.; Medina Radio Club, Medina, N. Y.; Palisades Radio Club, Fort Lee, N. J.; Nassau Radio League, Freeport, L. I.; Norwalk Amateur Radio Association, Norwalk, Ohio; Battle Creek Radio Club, Battle Creek, Mich.; Greenville Radio Club, Greenville, Ohio; City of the Straits Radio Club, Detroit, Mich.; The Waukesha Radio Amateur Club, Waukesha, Wisc.; Wooster Radio Club, Wooster, Ohio; The Oxford Radio Club, Oxford, Ohio; Minnetonka Radio Club, Excelsior, Minn.; Fargo-Moorhead Radio Club, Fargo, N. Dak.; Forx Y. M. C. A. Radio Club, Grand Forks, N. D.; Southern Minnesota Radio Association, Fairmont, Minn.; Madison Radio Association, Madison, S. Dak.; Radio Club of Jamestown, Jamestown, N. Dak.; The St. Cloud Radio Club, St. Cloud, Minn.; Wireless Club of St. Petersburg, Fla.; Miami Radio Association, Inc., Miami, Fla.; Campus Radio Club, Ames, Iowa; Independence Radio Club, Independence, Kansas; St. Louis Radio Association, St. Louis, Mo.; Boston College Radio Club, Chestnut Hill, Mass.; Milford Radio Association, Milford, Conn.; Community Radio Club, Natick,

Mass.; Millers River Radio Association, Athol & Orange, Mass.; Radio Council of Southern New England, Pawtucket, R. I.; Auburn Radio Club, Auburn, Maine; Radio Club of Manchester, Manchester, Conn.; Newport Radio Club, Newport, R. I.; Wenatchee Valley Radio Club, Wenatchee, Wash.; The Coeur d'Alene Radio Club, Coeur d'Alene, Idaho; Butte Radio Club, Butte, Mont.; Benson Tech. Radio Club, Portland, Ore.; "Y" Radio Club, Guelph, Ont.; Niagara District Radio Association, St. Catharines, Ont.; Sacramento Valley Radio Club, Sacramento, Calif.; Associated Radio Amateurs, Berkeley, Calif.; Glenn County Radio Club, Willows, Calif.; Radio Association of Danville, Danville, Va.; Peninsula Radio Club of Va., Fortress Monroe, Va.; Corsicana Radio Club, Corsicana, Texas; Brazos County Radio Club, Bryan, Texas; Desdemona Radio Club, Desdemona, Texas; Lubbock Radio Club, Lubbock, Texas; The San Marcos Radio Club, San Marcos, Texas; Pecos Valley Radio Society, Roswell, N. Mex.; Albuquerque Radio Club, Albuquerque, N. Mex.; The Moose Jaw Amateur Radio Association, Moose Jaw, Sask.; Moose Jaw Senior Amateur Radio Association, Moose Jaw, Sask.; Albion Radio Club of Albion High School, Albion, Mich.

#### **Rutherford (N. J.) Radio Club**

Meetings are held on the first and third Tuesdays of each month. Out of a total membership of forty-seven there are thirty active members. This club makes a strong effort to adhere to government regulations such as those relating to wave length, decrement, licenses and false calls, under the discipline of the ever-alert ears of its Traffic Manager, Mr. Benjamin Jackson.

Due to the popularity of the clubs' president, Mr. Richard C. Clunis, its members and their guests have been treated to some very interesting talks by prominent radio men such as Mr. Frank Bremer, pioneer radio phone broadcaster, Mr. Paul F. Godley, whose activities in amateur radio need not be mentioned, Mr. Pierre Boucheron, publicity manager for the Radio Corp'n. of America. The last two mentioned gentlemen are also members of this club. In June, probably the 16th, Mr. Meyers, manufacturer of audion tubes will talk to the club and demonstrate his multi-stage amplifier.

### Belmar (N. J.) Radio Club

The Belmar Radio Club held a radio convention on June 9th, at which all the newest and best apparatus was on display, including the new Western Electric amplifier and loud speaker. Paul F. Godley spoke on "The Future of Amateur Radio." We hope to have a further report on the success of the show.

### East Gulf Organ

The gang of the A.R.R.L. in the East Gulf Division have started one of the liveliest and peppiest division organs that you ever saw under the name of the "East Gulf Radiogram." The first issue is out for May and has good technical articles and a wealth of amateur spirit. Mr. H. R. McMillan is managing editor, B. W. Benning (Division Manager) and H. L. Reid are associate editors, with W. A. Ward as advertising manager.

Our best wishes to a peppy outfit. We shall expect great things of the "East Gulf Radiogram."

### The Reading (Pa.) Radio Club

On May 12th we celebrated our affiliation with the A.R.R.L. by a radio dance which was very successful.

Our club now has forty members, the officers of which are, Harold O. Landis, pres.; Clarence Leinbach, vice-pres.; Clarence J. Hartman, treas.; Carl E. Kunsman, sec'y; C. C. Levan, asst. sec'y; and Clifford Trout, publicity mgr.

We have our headquarters at the P. & R. Y.M.C.A., where a transmitting and receiving set is installed. The transmitter consists of a 1 K.W. Acme transformer and rotary spark gap, and the receiver is made up of a short-wave regenerative tuner and two-step amplifier and Magnavox. We have two antennas, one being ninety-five feet high and one hundred and thirty-five feet long with six wires, and the other, fifty-five feet high and seventy-five feet long with four wires. Both of them are of the inverted L type. The station, whose call is 3BDP, is now open for traffic, with regular operators on duty each Tuesday, Wednesday and Friday evening.

Meetings are held every second Friday, when besides the regular business proceedings, the QRM Committee makes its report, a short session of omnigraph practice is given, and a discussion is made of a subject selected at the previous meeting.

### Schnell West

At this writing our Traffic Manager, Fred H. Schnell, is making a tour of the west coast states where he will call upon as many of the affiliated clubs as his limited time will permit.

### "The Michigan Radioist"

The May-June issue of the Michigan

Radioist published by the Central Michigan Wireless Association of Lansing, and devoted to Michigan amateur interests, is a Battle Creek number and concerns itself in interesting fashion with activities in and about Battle Creek. A page in its latest issue is devoted to an explanation of what the A.R.R.L. is with an invitation to the public to utilize the traffic routes in Michigan for the starting of free messages to any part of the United States or Canada. The affiliated clubs in Michigan are listed and the addresses given of the state traffic personnel. A splendid thing and one which other sectional organs might employ to tell the public what amateur radio is.

### The South Dakota "Oscillator"

"The Oscillator," published by the Y.M. C.A. Radio Club of Sioux Falls, S. D., has been issued for the last time this season but will be resumed in the fall.

The Oscillator has always been a very creditable little sheet full of sound, practical operating advice, and expressing so well that homey amateur atmosphere we love. The May 24th issue contained a comprehensive account of the Iowa State Convention. We have as yet received no report on this meeting from any of our Iowa clubs, but from its report in the South Dakota magazine it would seem that very interesting sessions were held.

### The Bronxville Radio Club (N. Y.)

Shortly after the war a group of radio enthusiasts in Bronxville formed a club under the name of the "Armour Villa Radio Association". The name of this organization has been changed to the "Bronxville Radio Club" within the last year and it is entering upon its fourth successful season. The "Bronxville Radio Club" is affiliated with A.R.R.L. and the officers of the club are as follows: president, Walter A. Remy (2KV); secretary, Rodney Roach; treasurer, James Maher (2AXP).

Meetings are held every other Friday evening in the Gramatan National Bank, Bronxville, N. Y., through the generosity and interest of the bank officials. The present membership of the club is 28, which number is rapidly increasing. We aim to make our meetings interesting for all by presenting a paper on some radio topic at each meeting, by answering the questions of the novice and giving him all possible advice, and by holding a general discussion.

We consider ourselves fortunate in receiving a complete DeForest fone and CW transmitter, motor-generator, etc. from one of the members, Mr. McAllister, towards a club station. A committee on erection has been appointed and is getting results. The station will be operating about the latter part of June and we are anxious to exchange messages with other organizations. Call 2AIH.

# Strays



Mr. M. H. Pancost, 8ZF, is a hero in Lansing, Mich., because of his excellent handling of news service by radio during the emergency when nearly all wires were down. With the aid of 8ZZ, Clyde Darr, who made news arrangements with WWJ at Detroit, 8AND, F. D. Fallain at Flint, 8ADY at Fenton, HIG, unlicensed station at Bay City, WHW at East Lansing, and 8BLW at Grand Rapids, all the news was received for two days. Another demonstration of the value of amateur radio in an emergency.

Mr. J. F. Carpenter, who was our hero of the storm relay routes described in April, was called upon again to give help in the case of another storm bringing down the wires of the Northern States Power Co. On a few minutes notice he grabbed a five watt C.W. set and drove with the General Supt. to St. Croix Falls, Wis., where communication was established back to 9XI in a few minutes and important messages handled over the 60 mile gap. Hot stuff! The station is still being maintained and more C.W. sets are being put in the other main plants now.

## The Difference

Spark: Watts-per-mile.

C.W.: Miles-per-watt.

New theory of propagation advanced by a reporter for the Fairmont, (W. Va.) Times, who speaks of sending messages thru the ozone, and also chronicles the use of several stages of exemplifiers. Shades of Herr Hertz!

M. S. Andelin, 6JT, Manager of our Rocky Mountain Division, stepped off this past June too. He says it does not mean that he is dropping out of the game, however, as he married the sister of a well-known DX amateur (QRA?) so there will be two operators at 6JT instead of one. Congratulations, OM!

The National Retail Assn. now has an Investigating Committee to look into the matter of quality and efficiency of radio apparatus and to get responsible manufacturers to plainly mark the receiving radius on their apparatus.

## Station Kinks

Every amateur has originated certain little kinks around his station that are very helpful. What have you done in this line that will interest the bunch? Here are some we made note of in a station we recently visited:

The regenerator was shielded by pasting tinfoil on the back side of the panel, carefully cutting it away around bushings, switch-points, etc. Capacity effects were nil, which is a great help in C.W. work.

A large-size B battery had been tapped at each cell by taking off the cardboard bottom, scraping thru the wax paper around each cell and soldering thereto a 1/2-inch length of No. 14 copper wire, and paraffine promptly poured over the tapped battery to exclude moisture. The battery is turned upside down and connection made to any desired cell by clipping on to the proper wire "stub".

A small board on short legs had a group of 1 1/2-inch holes bored in it and made a convenient holder for a dozen or so standard-base tubes.

The storage battery was connected to the blades of a D. P. D. T. switch which in one position connected it to the tube equipment and in the other to the charging rectifier. By throwing an additional switch to supply the rectifier with 110, the battery can then be charged without the inconvenience of disconnecting, running special wires, etc.

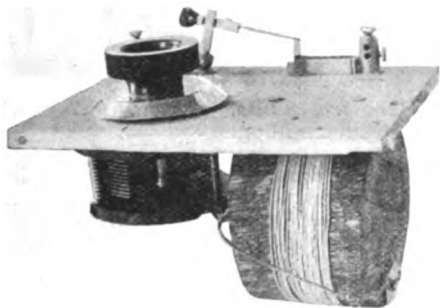
3BEC suggests drawing pencil lines on the base of detector tubes between the filament and grid posts for a leak. The advantage is that the tubes may be swapped but always have their best leaks with them.

Although 9ZN is in commission with the same apparatus as always, many of the old operators are scattered all over the country. Dutton, "DN", is operating on the S.S. George Washington, and Brennan, "MA", is on the west coast.

1AMD informs us that on March 6th he delivered the Governor-President message for Rhode Island to 8AJD. On the next two nights it was given to 1AZW.

According to newspaper clippings, a chap in Dubois, Pa., has a miniature radio that tunes to 289 meters, cost a total of 17c, and picks up Arlington. Why pay more?

The Detroit Police Dept. has been issued the call letters KOP. You speed demons better watch your step.



The above is supposed to be a wave-meter. It drifted into one of the testing laboratories for calibration. Yes, drifted—it couldn't sink because the coil is wound on a tree limb which would keep it afloat. Although the mud insulated condenser was still OK, and none of the unsoldered connections came off, the wire became very loose on the tree trunk on drying, so that calibration is subject to change without notice.

We have several requests on file for a thermocoupled antenna wattmeter calibrated to read directly in miles. QTC?

Several other good "Strays" were received too late for this column.

It's too bad we can't repeat all the foolish questions asked in radio gatherings and much worse that we can't answer them intelligently, at least to the asker.

That reminds us of the b.c.l. who bought a grid condenser and after unwrapping all the paper found it empty inside.

We understand that an antenna is a horn on the head of a bug. Moral: be sure of your nut.

To those who wish to learn more about radio we recommend "The Principles Underlying Radio Communication". This book was originally prepared by the Bureau of Standards for the Signal Corps in 1918 but has been revised and considerably increased in size. There is a wealth of information in it and it is absolutely up to date. It is durably bound and contains over 600 pages and 300 illustrations, many of which are photographs. This book may be obtained postpaid for one dollar from the Superintendent of Documents, Government Printing Office, Washington, D.C.

### Can You Imagine—

Eastern sparks being heard in Hawaii?

Selling tubes for 59c on bargain days?

New aerials staying put?

Your condenser not blowing when that "6" answers?

Less than five concerts on the same wave?

The good old days back again?

It is with deep regret that we learn of 1CK, the station of our New England Division Mgr., being burned on May 25th. His files were completely destroyed and his QST's as far as page 53 of the May issue, he says cheerfully.

With not half so much regret we learn that "Nick" Jensen, Dakota Division Manager, "stepped off" on June 7th. Another good A.R.R.L. man to desert the bachelor ranks. Congrats, OM!

### Read 'Em and Weep!

8GE has heard 6KA, 6ZZ, and 6XAD QSA.

8AM, 8BO, and 8EA have been heard in California.

8ZZ, Clyde E. Darr, has been heard in Colon, Panama.

5ZA has been heard at 1MO on two steps 200 feet from the phones.

2AFP has been reported in many central U.S. places while using one five watt tube and thirty foot single wire aerial.

9ZN has been heard on spark in Davenport, Iowa.

6ZZ has been copied on one tube by 1AZY in Rhode Island.

5AX in Prince Rupert, B.C., hears 4CB, 5ZA, 6ZI, 6ZAC, 7DP, 9AYU, 9WU, and 9BD, all on C.W.

9DSG has been heard 1250 miles on 5 watts, 180 meters, and single wire aerial.

8ACF in Pa. has been heard in Calif. by 6TI and 6ABU.

8VY has been reported QSA in Alaska and 425 miles west of NPE.

Investigation is now on foot to determine if the leading radio companies are restraining trade in the wireless field.

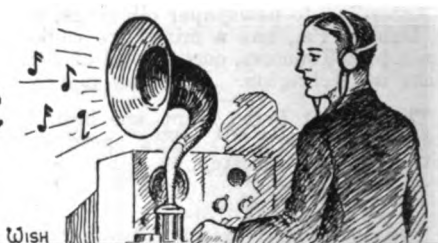
On July 19th the various offices of the Civil Service will hold a competitive examination for the position of Radio Inspector for the Department of Commerce.

On June first there were 28,362 receiving sets in Chicago.

2KF advises he will gladly make reception tests for any station writing him.

"If anyone wants to prove that he was heard in England during the Transatlantics, all he has to do is to claim that he signed 1AAW and she is did. There is a Kick-back to the proposition, tho."—"Kickbacks". We'll say so! We're still looking for the bird.

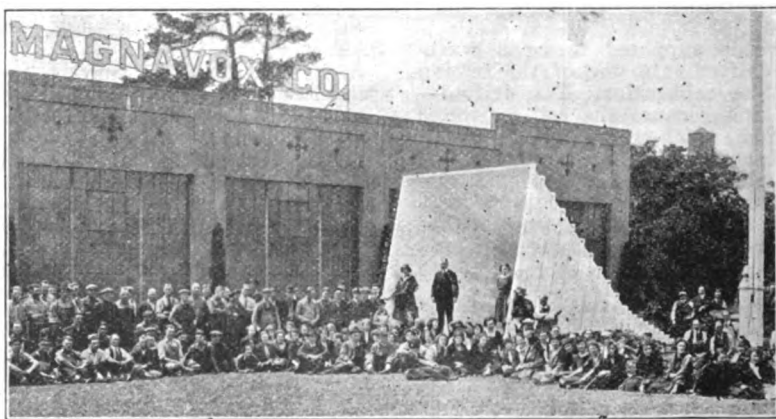
# With Our Radiophone LISTENERS



What is claimed to be the largest radio horn in the world is shown in the accompanying photo. It is installed in Idora Park, a public amusement resort in California. Equipped with a Magnavox reproducer and power amplifier the music picked up can be heard over an area of twenty-nine square miles.

it will be five million and in 1927 it will reach twenty million.

The radio broadcast craze has swept into Canada as well. We hear rumors that the station of "La Presse" in Montreal is due to be one of the largest in North America, operating under the call CKAC.



The horn measures thirty-five feet in length and has an opening twelve feet square. One thousand feet of clear aeroplane spruce lumber went into its construction. It is claimed that with the electrodynamic reproducer and the overcoming of the problems incidental in the design of such a large horn, distortion is eliminated.

Mr. E. P. Edwards, Manager of the Radio Department of the General Electric Co., in defense against the charge of holding back in the production of vacuum tubes to increase the demand, states that until last November 5,000 tubes per month kept the market supplied. In March he estimated the demand to be 90,000 per month at which time they were making 60,000. The production is now 200,000 tubes per month or about forty times as much as the production six months ago.

Dr. Lee DeForest is quoted as having said in a recent speech that the estimate of the radio public as being a million is highly conservative. He figures that in two years

## "What Is the Best Way to Learn the Code?"

"By and by they are going to get fed up with near-by stuff and the concerts, and how to peel potatoes, and one by one they are going to begin wondering about the little chirps and buzzings down on two hundred," says "The Old Man." This is the first symptom of the second bite of the little radio bug. A real amateur is in the making when one says, "What is the best way to learn the code?" Thousands of broadcast fans are asking this question to chance acquaintances in the radio stores, at radio club meetings especially advertised and everywhere the whole country over. Congratulations! We welcome you into this amateur field of ours.

But now about this "dah dit dah" stuff. We old timers had our trials and tribulations in getting started. Most of us learned the code from a printed card, a catalogue of a mail order house, or a library book. We learned that A was "dot-dash," B "dash-dot-dot-dot," and C "dash-dot-dash-dot." Some of our number in a very short period could recite the whole

code in this way—just like memorizing poetry at school. Sounds simple, doesn't it? Yes, A was a little round dot followed by a long black mark, while B is a long mark followed by three dots and so on. But when the buzzes came in the receivers they weren't composed of round black dots and long thin dashes. Anyone learning the code in this manner is at a loss to understand the buzzings. If the sending is painfully slow—less than a word per minute—the well meaning would-be operator hears "dit-dah" and thinks to himself, "Let's see, that is a short and a long,—mmmm—dot-dash, mmmm—oh yes, it's A." Nuff sed! This way of learning the code is "debutique."

The way to learn the code is to learn it like you will have to receive it. The ideal way is to get someone to send to you, starting in from the first, without the code chart but learning the letters by sound. If this is impossible and you are forced to learn alone, try to associate the letters with long and short buzzes. Think of A as "dit-daah," B as "daah-dit-dit-dit," etc., with the accent on the "daah" which represents the longer element or the dash.

A buzzer practice outfit is quite a necessity in learning the code and no doubt most of it can be used later in a transmitting set. Complete outfits can be purchased for from \$2.50 to \$4.00. If the parts are bought separate, connect up the battery, key, and buzzer in series; that is, arranged in an electrical circle so that the current must go thru any unit to get to the next. It makes no difference in which order they are arranged or the polarity. In sending, grasp the key firmly with the thumb over the edge of the key knob. The key should be far enough back so the elbow will rest on the table with the wrist in the air. The wrist should be flexible with the motion coming from the forearm instead of the fingers. Practice the code by sending each letter several times, paying attention to the sound of the letter after the third time as if someone else was sending and along with each character think of the letter it represents. This increases the association between the sound and the letter, which is the main thing in receiving.

"If I were a broadcast listener and wanted to learn the code," says Hiram Percy Maxim, President of our A.R.R.L., "I would learn the numbers first. Then when listening in and hearing a station sending his call with a dit-dit-dit-dah-dah I would know he was located somewhere around Washington, D. C. Maybe it would be dah-dah-dah-dit-dit which would mean he was west of here, maybe in Ohio. Then on good nights when everything was right I might hear a station sign a call with a dah-dah-dah-dah-dit in it and then I would know I was reaching out and had heard

someone in the middle states. I would send fifteen cents to the Superintendent of Documents, Government Printing Office at Washington and when I got so I could pick up all of the letters in the call I would refer to the call book and drop the station owner a card telling him how I got him. Perhaps this would be a record for him and I would share in the honors. The fascination of *distance* is the thing that holds the interest in amateur radio. Why is it that little interest is taken in local broadcasts? The listeners would rather hear Pittsburgh, Springfield, Detroit, or some distant station even tho the quality of the program is the same because it is *further*. The same is even more true in amateur radio. The desire to receive long distances and know where the signals are coming from is one of the strongest incentives to learn the code."

There are all kinds of charts and methods suggested for learning the letters. Some are as good as others are bad. The fact remains, however, that all of the letters have to be mastered and the total number remains the same. Probably the dot letters would be well to start on—E, I, S, H, 5—and then the dash combinations—T, M, O, and zero. These should be thoroughly learned so that they are understood when mixed in all possible combinations. From this point on there seems to be considerable controversy as to which letters to learn next. To learn letters along with their opposites seems offhand to be a short cut. The learner quickly recognizes that the signal is either one of the opposites but is in doubt which and is just as liable to guess the wrong one. In fact when the code is learned in this manner it takes a long time before the learner can instantly and decisively choose the correct letter from its opposite. Difficulty is encountered in choosing between F and L, Y and Q, A and N, W and G, B and V, etc., when these letters are learned together.

Mr. Maxim is trying out a novel stunt in teaching the code with a small phone set by which he announces the letters in connection with his crashing 1AW spark, by which the listeners are taught to recognize the letters direct by sound. Words and other combinations of the letters already mastered are sent and checked when repeated on the phone. Though at this writing the course is about half completed the interest taken by dozens of men, women and children, indicates that it is novel, very interesting, and easy to learn the code this way.

It appears then that though there may be some advantage in learning certain letters first, the important thing is to learn by sound as in actual reception and not by visualizing the code on a printed card.

—B. P.



This is Miss Eunice Randall who sends thousands of youngsters to the Land of Nod every Tuesday and Thursday night. The above illustration shows her broadcasting her soothing tales from WGI to a family circle of 1,000 miles.



Miss Randall is one of the pioneer figures in radio broadcasting and is known from coast to coast. As far as known she is the only woman designer in the radio industry as she is employed by the Amrad Corp. daytimes. She is also an old A.R.R.L. member and operates a good "ham" station, 1CDP.

### A NEW RADIO BILL

(Continued from page 32)

#### A BILL

To amend an Act to regulate radio communication, approved August 13, 1912, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of Congress entitled "An Act to regulate radio communication," approved August 13, 1912, is amended by striking out sections 1, 2 and 3 thereof and by inserting in lieu thereof the sections 1, 2 and 3 following:

"SECTION 1. A. That no person, company, or corporation within the jurisdiction of the United States shall use or operate any apparatus for radio communication by telegraphy or telephony as a means of intercourse among the several States or with foreign nations, or upon any vessel of the United States engaged in interstate or foreign commerce, or for the transmission of radiograms or signals by telegraphy or telephony the effects of which extend beyond the jurisdiction of the State or Territory in which the same are made, or where interference would be caused thereby with the transmission or reception of messages or signals from beyond the jurisdiction of said State or Territory, except under and in accordance with

a license in that behalf granted by the Secretary of Commerce and except as hereinafter authorized.

"B. That the Secretary of Commerce from time to time shall (a) classify licensed radio stations and the operators required therein; (b) prescribe the nature of the service to be rendered by each class of licensed station and assign bands of wave lengths thereto; (c) make, alter, and revoke regulations applicable to all licensed stations not inconsistent with this Act or any other Act of Congress or with the terms of any radio communication convention to which the United States is a party concerning the service to be rendered by each class of stations so established; the location of any station; the wave lengths to be used by any station; the kinds of instruments or apparatus in any station with respect to the external effect produced thereby; the power and the purity and sharpness of the waves of each station or the apparatus therein; the area to be served by any station and the times and methods of operating any station or the apparatus therein; (d) make such other regulations not inconsistent with law as he may deem necessary to prevent interference between all stations affected by this Act.

"C. That radio stations belonging to and operated by the United States and used exclusively for communication of official business shall not be subject to the provisions of paragraphs A and B of this section. Every other station owned and operated by the United States shall be subject to the provisions of said paragraphs A and B of this section. All stations owned and operated by the United States and all other licensed stations on land or sea shall have special call letters designated by the Secretary of Commerce, and such stations and the designated call letters shall be included in the list of radio stations of the United States as published by the Department of Commerce. Radio stations owned and operated by the United States and used exclusively for the communication of official business shall use such wave lengths as shall be assigned to each by the President, and shall observe such regulations as the Secretary of Commerce may make to prevent undue interference with other radio stations and the rights of others, except that upon proclamation by the President that there exists war or a threat of war or a state of public peril or disaster, or other emergency, the President may suspend for such time as he may see fit all such regulations of the Secretary of Commerce applicable to such stations owned and operated by the United States.

"D. That every such license shall provide that the President of the United States in time of war or public peril or disaster may cause the closing of any station for radio communication and the removal therefrom of all radio apparatus, or may authorize the use or control of any such station or apparatus by any department of the Government upon just compensation to the owners.

"SEC. 2. A. That paragraph A of section 1 of this Act shall not apply to persons sending radio messages or signals through a radio station belonging to and operated by the United States for the transmission exclusively of official business nor to persons sending such messages on a foreign ship while the same is within the jurisdiction of the United States.

"B. That the station license required hereby shall not be granted to, or after the granting thereof such license shall not in any manner, either voluntarily or involuntarily, be transferred to (a) any alien or the representative of any alien; (b) nor to any foreign government or the representative thereof; (c) nor to any company, corporation, or association organized under the laws of any foreign government; (d) nor to any company, corporation, or association of which any officer or director is an alien or of which more than one-fifth of the capital stock having voting power is owned or controlled by aliens or their representatives or by a foreign government or representative thereof, or by any company, corporation, or association organized under the laws of a foreign country.

"Such station license, the wave length or lengths authorized to be used by the licensee, and the rights therein granted shall not be transferred, assigned,

(Continued on page 69)





# Amateur Radio Stations



## 7XG, Portland, Oregon

This station was designed and built for Mr. W. P. Hawley, jr., by Mr. Chas. Austin of the Northwestern Radio Mfg. Co. of Portland. Four 50-watt tubes are used in Colpitts-Heising circuit, two as oscillators and two as modulators, with constant current modulation.

on the drum for lighting the filaments, starting the generator, etc. Likewise all the necessary switches are changed when the drum is turned to "C. W." or "Chopper."

The chopper for I.C.W. gives a 900 cycle note.



Filament voltage of 9.75 volts is supplied by an Acme transformer. The plate current is supplied by a Robbins & Meyers motor-generator set. With a 10,000 ohm field rheostat the output voltage can be varied from 800 to 1500 volts. At the lower left hand corner of the transmitting panel is a drum switch control marked "Voice," "Receiving," "Off," "C.W." and "Chopper." When turned to "Voice" the set is ready for the transmission of speech or music thru the arrangement of contacts

The receiving apparatus consists of the usual variometer regenerative set designed to cover waves from 160 to 900 meters. For long waves a Colin B. Kennedy set is used. Either may be plugged to a two-step amplifier. A large Magnavox can be used with either set and has its own three stage power amplifier consisting of five watt power tubes operating two in parallel for each stage. Three banks of 108 volts furnish the plate voltage for each power amplifier.

The transmitting and short-wave receiving aerial is of the four wire T type, 40 ft. long. The poles were tapered in a lathe from 22 inches to 8 inches at the top and stand 100 feet high with no guys whatsoever. At the base the poles are bolted to concrete saddles and do not go into the ground where they would rot. The lead-in is bunched into a rat tail half way down. A six-wire counterpoise also of seven strand No. 20 phosphor bronze cables is directly below the antenna and extends 15 feet beyond at both ends. The ground system consists of 60 foot strips of three inch copper ribbon buried two feet apart and eight inches deep under the antenna. Both the ground and counterpoise are used giving 4 amperes in the antenna on voice and 5 to 5½ amperes on straight C.W. using two 50 watt tubes as oscillators. Great care is taken with insulation thruout the antenna system.

The operating room is of good size and contains the latest type of electric Victrola with Magnavox tone-arm and a Steinway grand piano with specially constructed spruce tone chamber for transmitting vocal and instrumental music. 7XG has been heard on C.W., I.C.W., and voice in the Hawaiian Islands. A new set with one 250 watt oscillator, one 250 watt modulator, and a 50 watt speech amplifier is under construction as is also an Armstrong Super Heterodyne amplifier of four steps to be used with the ordinary two-step audio frequency and four-step power amplifiers.

### SOME SUGGESTIONS REGARDING THE BEVERAGE ANTENNA

(Concluded from page 13)

in the ground lead in order to neutralize it. A condenser alone would do but a more flexible arrangement would be to use an inductance in series also. This inductance

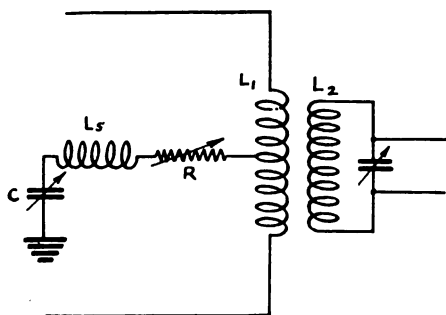


FIG 3

should have taps and range from 30 to 50 turns on a four inch tube. See Figure 3. When the condenser is inserted, the induc-

tive reactance of the circuit is neutralized by the capacity reactance of the condenser and there is left only the resistance of the transformers and the resistance  $R$ . The values of condenser or inductance will have to be changed for each wave length used. The system described should give good results from 150 to about 600 meters if the wire is long enough.

Many statements made here are subject to criticism but the writer is not attempting to give exact values for short wave work, as it is rather problematical to say the least.

### BOOK REVIEW

(Concluded from page 48)

The chapter on receiving sets briefly describes the construction of a single circuit tuner using a crystal detector, a loose-coupler set with a straight audion detector, and a regenerative audion set. There are no photographs of this equipment and the reader is abruptly pitchforked into the mazes of schematic circuit diagrams with the injunction to secure a loose-coupler and certain other pieces of apparatus and hitch them up as per figure so-and-so, in a manner certainly much less understandable than that employed by Mr. Lescarbours.

Nevertheless it is an excellent book for the novice listener, full of sound practical advice from the amateur's standpoint.

—K.B.W.

### A NEW "CHICAGO PLAN"

(Concluded from page 34)

interest of life and property requires special permission at additional fees before station apparatus can be moved or changed and yet permits anything desired to be done with the antenna is a terrible big joke, and obviously not at all designed in the public interest. In other words, it is much easier for an inspector to look over the apparatus in one's den than to climb out on a scorching hot house-top to inspect an aerial; and of course the average experimenter is going to improve and re-arrange his station apparatus much more often than he will make changes in his aerial, which means that many more re-inspection fees.

We regard the proposed Chicago radio ordinance as an iniquitous piece of business against the public interest and designed purely for graft. Chicago is infamous for that sort of thing, and it looks like the crooked politicians of the "Windy City" were endeavoring to get some "jack" as the result of the immense novice interest in radio. They are of course stepping on the toes of us amateurs in doing so. We think every A.R.R.L. member in Chicago should use his influence to the utmost to prevent the enactment of this ordinance.

# Calls Heard



## HEARD DURING MAY Unless Otherwise Specified

Heard At Sea By Ex-3HJ Aboard S.S. West Nossaka

March 23 (60 miles south of Baltimore) C.W.: 2FP; Spark: 1SN, 2FP, 2RM, 2ARY, 3QN, 8AJT, 8AY, 8UC, Can. 3EI, 3KG. March 24 (Norfolk) C.W.: 1BGF, 1PT, 2FP, 2BNZ, 3AQR, 3BHL, 3BZ, 3SQ, 4ZC, 5DA, 8BEF, 9IO; Spark: 3QW, 8BAZ, 9LF, Can. 3GN. March 25 (100 N.E. Norfolk) C.W.: 1AJP, 1BEP, 1BSD, 1XM, 2BNZ, 2BML, 2FP, 3AAG, 3BA, 3BHL, 3AY, 8QZ; Spark: 1ARY, 2WB, 3AGT, 3BG, 3FB, 3FP, 3YP, 3ZM, 4BE, 4EA, 8BZY, 8ZAC, 9AGA, 9OX. March 26 (150 E. Boston) C.W.: 1ADL, 1ARY, 2AVU, 2BEA, 2FP, 2WT, 3APQ, 3FS, 3IL, 3VW, 4LP, 8AGK, 8QZ, 9HW; Spark: 1BQA, 2AZC, 3AJD, 8AJV, 8ALO, 8BSS, 9LF, 9OX, 9UH. March 28-30 (Halifax) C.W.: 1BTR, 1BWJ, 1BRQ, 1AJP, 1RD, 1BSD, 1BUA, 1ASF, 1ADD, 1AFJ, 1AZW, 1BLE, 1CK, 1BKR, 2ABZ, 2AMO, 2CCD, 2BQU, 2AES, 2WT, 2BEB, 2ADV, 2OF, 2BCF, 2AJA, 2VH, 2AWF, 2BTJ, 2AYV, 2CFT, 2BNC, 2FP, 2CGQ, 2AAB, 3AQR, 3AJD, 3AQH, 3AAY, 3RF, 3BZ, 3VW, 3AAG, 3ADK, 3BUV, 3HG, 3IL, 3ANG, 8QZ, 8CFZ, 8UK, 8BDU, 8BBD, 8ADG, 8BK, 8AVD, 8OZ, 8AWP, 8AIO; Fone: 2DK; Spark: 1ARY, 1CZ, 1SN, 1DZ, 1OOK, 1BSZ, 1CM, 1YB, 1WQ, 1ADL, 1DHJ, 1BRQ, 1CGU, 2AAR, 2EL, 2WB, 3AJD, 3DM, 8AGT, 3AQI, 3LB, 3BCO, Can. 3BP, 3GE. April 1 (80 E. Halifax) C.W.: 1AJP, 1AZW, 1BLE, 1CMK, 2BNZ, 2SQ, 3ALN, 3BA, 3BZ, 3BJ, 4GL, 4ID, 8ADG, 8BDU, 9ARK; C.W.: 1XM, 1BES, 2NZ, 3FS, 3QZ, 8AVD, 8PT, 8QB; Spark: 1AKG, 1BQA, 1AW, 1CC, 1CM, 2ARY, 2WB, 2RM, 2DN, 2JZ, 5FO, 5HK, 8ARD, 8AFD, 8OD, 8WD, 8ALO, 8VH. April 2 (800 E. Boston) C.W.: 1AKG, 8AIO, 8BSS.

7BJ on WSR (from Astoria, Ore. to Chignik, Alaska)

April 12 (410 west NPE Northhead, Wash. 7ZS, 6XAF, 7YL, 7YA, 6ZB, 7XG, 5XU, 6ZT, 6BJV, 6AJH, 6AVM, 6AMN, 6AAK. April 15: (415 west NPE) 6XAD, 9BED, Can. 9BD, 9WU, 6BCD. April 16: 9IL, 6XAD, 9AXF, 9AIY, 8VY, 9CBA. April 17: (490 west NPE) 9DOF, 9AIY, 9AJA, 9FM, 8EA, 9ARZ, 9XI, 9XAQ. April 18: (610 miles west NPE) 6OO, 6ZX, 6AAT, 6EA, 6GY, 7NN, 7NF, 6AGP, 7SC, 6BCD, 7TO, 7DP, 7RN, 7IW, 5OL, 9WQ, 9WD, 7WE, 6KY. April 19: (790 west of NPE) 5XU, 5OI, 9AOG, 6GD, 6KA, 6JZ, 6ZZ, 7KS, 9WU, Can. 9BD, 6KU, 6AIB, 7SC, 6BES, 7NN, 6ANG, 7BH. April 20: (840 west of NPE) 7KS, 6KU, 9BAJ, 9AYU, 6EN, 6ALU, 6KA, Can. 5CN, 9WU, 6XAD. April 21: (900 miles west of NPE) 6BES, 7NN, 7DP, 6ZI, 9AJA, 6KA, 6KU, 7FR, 7MU, 6AJH, 6XAD, 6GD, 6ALA, 6BB, 6ZAC, 6ZC. April 22: (1000 miles west NPE) Can. 9BD, 6ZZ, 6ZI, 6CU, 6ZQ, 6ZF, 9ZAF, 6BES, 6ALU, 6XAD, 6AQU, 7FR, 6XH, 6AWP, 7NA, 7GA, 6HY, 6EX, 7CU, 6HC, 6AWT, 6KA. April 23: (1190 miles west NPE) 6EA, 7SC, 7QE, 7DP, 6XAD, 7NA, 7BH, 7BK, 6NX, 7NN. April 24: (1250 miles west NPE) 6BES, 6ZX, 6CC, 6KA, 6EX, 7KS, 6AJI, 7MF, 6KM, 6BEG, 6EA, 6XAD, 6AIN, 7ZK, 6GF, 6AAK, 6AJR, 7DP. April 25: (1325 miles west NPE) 6KA, 6AJR, Can. 9BD, 6BES, 6EN, 7ZK. April 26: (1450 miles west NPE) 6KA, 6AJR, 7DP. April 27: (1525 miles west NPE) 6KA, 7DP. April 28: (In Chignik at anchor) 6KA, 7NN, 6NX, spks in but QRN.

Can. 5AX, Prince Rupert, B. C.  
Canadians: 4CB, 5AK, 5CH, 5CN, 5CX, 5DO, 9BD.

Americans: 5ZA, CL8, 6EB, 6EX, 6KA, 6KI, 6VM, 6ZG, 6ZI, 6ZF, 6ZQ, 6ZZ, 6AJR, 6BES, 6XAD, 6ZAC, 7AAV, 7BK, 7BS, 7DP, 7ED, 7GE, 7HI,

7IW, 7JD, 7KS, 7MF, 7NA, 7NN, 7OZ, 7QE, 7RN, 7SC, 7WE, 7WG, 7YD, 7YS, 9AYU, 9WU.

Can. 3QP, 169 Elm Ave., Windsor, Ont.  
C.W.: 1AZW, 2BFX, 3IW, 3BEH, 3BIC, 8HV, 8PT, 8VQ, 8VU, 8AGO, 8BEF, 8BRQ, 8BUX, 8BWZ, 9DV, 9EI, 9FZ, 9LF, 9LY, 9UU, 9XI, 9AIY, 9AJA, 9DQG, (Can) 3CX.  
Spark: 3HJ, 4BI, 8EW, 8NO, 8VQ, 8ZO, 9CP, 9GX, 9PD, 9AMT, 9BHD, (Can) 3GX.

1AOK, Melrose Highlands, Mass. (1 Tube)  
Spark: (1ARY), (1BCF), 1RBQ, 1BOE, (1BVB), 1CHJ, 1CM, (2BY), (2CT), (2EL), 2FP, 2GR, (2JH), 2MN, 2OM, (2PF), 2PV, (2RM), 2TF, 2TS, 2WB, 2AAF, 2AHU), 2ARB, 2ARF, 2ARY, 2AQI, 2AWF, 2AYY, (2BGD), 2BHQ, 2BKK, (2BRI), 3AAB, 3ABE, 3ACK, 3AJD, 3AQR, 3BFU, 3BJL, 3BVO, (3AC), 3BJ, (3CS), (3FP), (3HJ), (3II), 3JW, (3PU), 3RW, (3TA), 3UD, 3UC, 3WT, 4EA, 4CX, 8AFD, 8AHE, 8AHQ, 8AXO, 8AXQ, (8AXX), 8BAZ, 8BFY, 8BKA, 8BNB, 8BYF, 8CER, 8DY, 8EO, (8EW), 8KY, 8MZ, 8UC, 8VQ, (8VW), 8WD, 9AAW, 9UH, 9VL, 9ZN, Can. (3JL), 3GX.  
C.W.: 1AWB, 1AZW, 1BDI, 2AFP, 2AWF, 2AYV, 2BEB, 2BEH, 2BFX, 2BML, 2BNZ, 2BOG, 2BQU, 2BYC, 2FP, 2NZ, (2RM), 3ALN, 3AJD, 3BJ, 3BLF, 3BRW, 3CAL, 3FP, 3GN, 3IW, 3LR, 8ADG, 8AHO, 8AMM, 8AVL, 8AQO, 8BJS, 8BLX, 8CJH, 8CKO, 8CON, 8LB, 8UE.

1BRQ, Lewiston, Me.  
Spark: (1AA), (1ACO), 1ADC, 1AGI, (1AKG), 1ALK, (1AMQ), 1AOK, (1APT), 1ARY, 1ASK, 1AW, 1AZK, 1BDT, (1BEK), 1BEP, (1BJS), 1BVU, 1BWY, (1BYG), 1CE, (1CHJ), 1CHX, (1CK), (1CIB), (1FM), 1FS, 1GM, (1LZ), 1RH, 1RV, 1TU, 1WQ, 2ABB, 2AHU, 2AIC, 2ARB, (2AWF), (2BBN), 2BFX, (2BKK), 2BTJ, 2CT, 2EL, 2EQ, 2KK, (2RM), 2RN, (2OM), 2PF, (2PU), (2TF), 2TS, 3ABB, 3AHU, 3AJD, 3ALO, 3BFU, 3BLF, 3BU, 3BVC, (3FP), 3GX, 3IR, (3PU), (3TA), 3ZM, 4EL, 8AFA, 8AFD, 8AHQ, 8AQO, (8BNB), 8BQA, 8EO, 8JY, 8UN, 9AFC.

C.W.: 1ADL, 1AGI, 1AIP, 1AJP, 1AQK, (1ARY), 1ASF, 1ATJ, 1AUN, 1AWB, 1AWE, 1AZD, (1AZW), 1BAS, (1BBW), (1BDI), 1BEP, 1BES, 1BGF, 1BIE, 1BKA, (1BKK), 1BKQ, 1BKR, 1BLN, 1BNT, 1BQE, 1BUA, 1BUU, 1BW, 1BWJ, 1BYG, 1CAK, 1CBP, (1CDO), 1CHJ, 1CJH, 1CIK, 1CIT, 1CLL, 1CMK, (1CPN), 1CRU, 1GV, 1IU, 1JG, 1OK, (1PR), 1PT, 1RD, (1UL), 1XA, 1XG, 1XM, 1XX, 1YB, 1YK, 2ABQ, 2AEU, 2AFP, 2AJA, 2AJF, 2ANM, (2AQI), 2AQL, 2ARY, (2AWF), 2AWK, 2AWL, 2AXK, 2AXY, 2AYH, 2AYV, 2AYZ, 2AZD, 2BBB, 2BCF, 2BDG, 2BE, 2BEH, 2BLJ, 2BLP, 2BML, 2BNZ, 2BHQ, 2BQU, 2BRC, 2BTJ, 2CBW, 2CDK, 2CIZ, 2CRI, 2CT, 2DK, 2EH, 2EL, 2FP, 2FZ, 2LH, 2RY, 3AAY, 3AB, 3ADX, 3ALN, 3AQH, 3BG, 3BJ, 3BLF, 3BNU, 3CG, 3FR, 3HG, 3IW, 3LC, 3VW, 3ZS, 3ZO, 4DC, 4GL, 4LP, 8ADG, 8AGO, 8AHK, 8AIO, 8ALB, 8AM, 8AMM, 8AMQ, 8AQO, 8AUH, 8AUY, 8AVD, 8AVL, 8AWP, 8AXE, 8BDU, 8BEO, 8BJS, 8BKH, 8BLX, 8BX, 8BXH, 8CFK, 8CFP, 8CJH, 8CKM, 8CKO, 8HJ, 8HM, 8OZ, 8SE, 8SZ, 8UA, 8UC, 8UE, 8VW, 8VY, 8XE, 8ZE, 8ZG, 9ARK, 9BHQ, 8BIQ, 3BP.

1NW, Danbury, Conn.  
Spark: 1AA, 1ADC, 1AHF, 1AKG, 1ARY, 1AOK, 1AW, 1AZK, 1BJS, 1BQ, 1BRQ, 1CHJ, 1CSP, 1DL, 1DY, 1IN, 1LB, 1RV, 1SN, 1WQ, 2CT, 2EF, 2EL, 2OM, 2PV, 3ABB, 3AVS, 3BFN, 3BVC, 3BX, 3FP, 3GX, 3ZZ, 4CX, 8AFD, 8APB, 8APH, 8BAD, 8BSS, 8BU, 8CQL, 8FT, 8KY, 8MP, 8TC, 8UC, 8VQ, 8ZO, 9AAW, 9AFK, 9AZA, 9US, 9ZN.  
C.W.: 1ADL, 1AGI, 1AIP, 1AJP, 1AJU, 1APE,

1ARY, 1AWB, 1AYQ, 1AZW, 1BBW, 1BDI, 1BGF (fone), 1BHW, 1BKA (fone), 1BIB (fone), 1BKQ, 1BLE, 1BUA, 1BWJ, 1BYG, 1CAK, 1CBG, 1CDD, 1CHJ, 1CIK, 1CIT, 1CJA, 1CMK, 1CNE, 1CNR, 1CSL, 1FZ, 1GV, 1IV, 1JT, 1OZ, 1PM, 1PR, 1QP, 1RH, 1UJ, 1VJ, 1WF, 1WQ, 1XA (fone), 1XM, 1XX, 1XY, 1YB, 1YK, 2AJF, 2ASV, 2AWF, 2AWS, 2AYO, 2BAI, 2BBX, 2BD, 2BDG, 2BQN, 2BRC, 2BTA, 2BTJ, 2BYC, 2CBG, 2CBK, 2CCT, 2CDA, 2CEN, 2CFT, 2CGE, 2CIM, 2CP, 2EH, 2FP, 2IV, 2LC, 2NZ, 2VC, 2VH, 2XAI, 2XAY, 2ADX, 2AJD, 2APD, 2BG, 2BGT, 2BHL, 2BKL, 2BZ, 2FP, 2FS, 2HN, 2IW, 2SZ, 2TJ, 2UW, 2VH, 2XW (fone), 2ZO, 2BY, 2DC, 2DS, 2ACF, 2ADG, 2AGO, 2AMQ, 2AQO, 2AAQZ, 2AWM, 2AWP, 2AWT, 2BCU, 2BDU, 2BEO, 2BIL, 2BFX, 2BLX, 2BO, 2BR, 2BRW, 2BSO, 2BXT, 2CAZ, 2CCM, 2CCG, 2CJA, 2CJH, 2CJY, 2CKM, 2CKO, 2CDO, 2CPX, 2CWB, 2EA, 2FT, 2HJ, 2JU, 2KH, 2NB, 2PT, 2SE, 2UE, 2UK, 2UY, 2WP, 2XE, 2YD (fone), 2ZW, 2ZZ, 2ARV, 2AUF, 2BSL, 2CBA, 2DYN, 2VQ, 2WA.

#### 1BFA, Arlington, Mass.

Spark: 1ACO, 1AOK, 1DP, 1GM, 1QO, 1LZ, 1SH, 2AHU, 2AWF, 2BRN, 2BRL, 2BGD, 2EL, 2RM, 2TJ, 2PV, 2WB, 2AWF, 2BVC, 2BSH, 2EH, 2FP, 2JW, 2PB, 2PU, 2AVR, 2APB, 2MU.

C.W.: (1CIT), (1BYG), (1CBJ), 1BUA, 1ADL, (1AYD), (1CJD), 1BKQ, (1PR), 1BKA, 1BTL, 1FO, 1HM, 1UJ, 1QP, 1CNE, 2AJF, 2AQM, 2AGC, 2AQH, 2AXK, 2AWF, 2AFP, 2BXP, 2BGJ, 2BEH, 2EQU, 2BRB, 2BAI, 2BRC, 2CDD, 2NZ, 2WR, 2ASP, 2AVY, 2APD, 2ADK, 2AQH, 2AJD, 2BA, 2BG, 2CAN, 2FS, 2FS, 2FR, 2CG, 2XA, 2XJ phone, 2AVD, 2ACH, 2AQF, 2BLX, 2BXT, 2BXY, 2BJS, 2BEO, 2CKM, 2CJH, 2NB, 2SE, 2UU, 2KP.

#### 2AWF, Albany, N. Y.

Spark: (1AA), 1AOK, 1AW, 1BOQ, (1BRQ), 1CHQ, 1CK, 1GM, (1RV), 1WQ, 2AD, 2AHU, 2ARB, 2ARY, 2BFX, 2CKO, (2CT), (2DI), (2EL), 2FP, 2OM, (2RM), 2TS, (2WB), 2ABD, 2AW, 2AWF, 2BFU, (2BJ), 2BVC, 2CS, 2EH, 2FB, 2FP, 2GX, 2PB, 2PU, 2WT, 2ZM, 2EA, 2AFD, 2AHE, 2AHQ, 2ANV, 2APB, (2AXX), (2BAC), 2BDV, 2BKA, 2BRL, 2CQL, 2DY, 2EO, 2EW, 2KY, 2MR, 2MU, 2QE, 2RQ, 2VQ, 2XE, 2ZO, 2FS, 2MC, 2UU.

C.W.: 1ADL, 1AJL, 1AYZ, (1AZW), (1BBW), 1BES, 1BKP, 1BWJ, 1CGO, (1CHJ), 1CJH, (1CNE), 1CNR, 1EO, 1FW, 1GV, (1IX), 1KI, 1QP, (1UL), 1UJ, 1XE, 1XX, 1XZ, 1YK, 1ZE, 2AEQ, (2AFP), 2AJA, 2AQL, 2AYF, 2AYV, 2BCF, 2BDG, 2BEH, 2BEH, 2BGJ, 2BQK, (2BRC), 2BUX, 2BYS, 2CAL, 2CBG, 2CBW, (2CDK), 2CEC, 2CEN, 2CFT, 2CT, 2CWE, 2FP, 2KP, 2NZ, 2RM, 2VH, 2WB, (2WR), 2ADX, 2AGN, 2ANJ, 2ANY, 2BA, 2BED, 2BJY, 2BLF, 2BOF, 2BUP, (2BZ), 2CAL, 2CG, 2FR, 2FS, 2HD, (2IW), 2LC, 2QV, 2SJ, 2TJ, 2UE, 2VW, 2WF, 2XA, 2ZO, 2BY, 2GH, 2KC, 2LP, 2XD, 2YJ, (2ACF), 2AHK, 2AIG, (2AIO), (2AMD), 2AMQ, 2ANB, 2AWM, 2AWP, 2AWT, 2AXB, 2AXC, 2BCL, 2BDB, 2BGM, 2BIS, 2BKE, 2BLW, (2BLX), 2BMM, 2BPU, 2BPW, 2BSO, 2BUX, 2BWK, 2CBR, 2CGM, (2CJH), 2CON, (2CQL), 2EA, 2LB, (2PT), 2UC, 2UE, 2UK, 2VQ, 2XE, 2XJ, 2YD, 2ZAE, 2ZX, 2AFN, 2AIY, 2AJH, 2AXF, 2BHD, 2BVP, 2DGO, 2DZQ, 2EL, (2JR), 2KP, 2UU, 2AN, 2AF, (2PB), Fone: 1BKA, 2XJ, 2ZK, 2XW.

#### 2BEH, Brooklyn, N. Y., All C.W.

(1ADL), 1AIP, 1AMQ, (1ARY), (1AUN), (1AYZ), (1AZW), (1BBW), (1BDI), (1BES), (1BET), 1BGF, 1BNT, 1BRQ, 1CDO, (1CGO), 1CHJ, 1CIK, 1CNE, (1CNR), 1DF, 1GV, (1IV), (1IX), (1PR), (1QP), 1UJ, 1XA, (1XX), 1XZ, 1YB, (1ZE), 2ADT, (2ADX), 2AIS, (2AJD), (2ALN), 2ALO, 2ANJ, 2ANQ, 2AQH, (2ARO), (2BEC), (2BG), 2BHL, (2BJ), 2BJY, 2BLF, 2BLR, (2BNU), 2BSH, 2BUV, 2CAN, (2CC), 2FS, 2HG, 2IW, 2LC, 2PB, (2QV), 2TJ, 2VS, 2VW, 2WF, 2XA, (2ZO), 2BY, 2DC, 2GX, 2YJ, 2ADG, (2AGO), (2AIO), (2ALB), 2AM, 2AMM, (2AMQ), 2ANB, (2AQZ), 2ASV, 2AVL, (2AWM), 2AWP, 2AXC, 2BAS, 2BCF, (2BCL), (2BDB), (2BDU), 2BIL, 2BJS, 2BLO, (2BNU), (2BO), 2BRT, 2BRW, (2BVR), 2BXT, (2CAY), (2CAZ), 2CFP, (2CGB), (2CJH), 2CKM, 2CC, (2UC), (2UE), 2UK, (2VQ), 2VR, 2VY, (2WR), 2XE, 2AJA, 2ARK, 2AXF, 2BED, 2BK, (2CT), 2DFB, (2DGO), 2DV, 2EL, 2FZ, (2IO), 2LQ, 2UU, 2WA.

#### 2BXY, Elizabeth, N. J.

C.W.: 1ABA, 1RU, 1XM, 1ZN, 1AFV, 1BCG, 1BUA, 1CAK, 1COD, 2AAB, 2AJF, 2AQU, 2AWL, 2AYI, 2BDM, 2BGJ, 2BGM, 2BML, 2AAO, 2ACP, 2ADV, 2ADK, 2AE, 2AF, 2AGE, 2BBY, 2BDQ, 2GL, 2AO, 2CO, 2HZ, 2CF, 2CH, 2LD, 2QF, 2ABO, 2ACL, 2AGO, 2AMP, 2ATD, 2VC, 2WN, 2AAO, 2ADK, 2AWK, 2DRK, 2UY, 2DAQ, Spark: 1AA, 1ADL, 1APX, 2ABB, 2ARM, 2QW, 2XM, 2ZO, 2AS, 2ZF, 2GI, 2HK, 2XM, 2ABY, 2AWP, 2BUN, 2ZAA, 2DZY.

#### 2BUQ, Staten Island, N. Y. C. (One Tube)

C.W.: 1AR, 1AW, (1FW), 1IL, (1IV), (1IX), (1JT), 1OZ, 1PR, (1RD), 1QP, (1UL), (1VQ), 1XX, 1YB, (1ZE), 1ADL, 1AJF, fone, (1ACL), (1ARY), (1AWB), (1AYZ), 1BBW, (1BKP), 1BKQ, (1BRQ), 1BWJ, 1BWY, 1BXY, 1CGO, (1CHJ), 1CJA, 2BG, 2CC, (2CG), 2FP, 2FS, 2HG, (2IW), 2LC, 2NH, 2QV, 2RF, 2TZ, 2VW, 2ZO, 2AJD, 2ANJ, 2AQH, 2BHL, 2BJ, 2BJY, 2BLF, 2BQ, 2BY, 2GL, 2GU, 2GX, 2KC, 2LP, 2XD, 2ZC, 2FV, 2DA, 2AW, (2BU), (2DV), 2EA, 2HJ, 2LD, 2LW, (2NB), (2PT), 2RQ, (2TO), 2UE, 2UC, 2VQ, 2V, 2XE, 2ACF, 2AIM, 2AWM, 2AWP, 2ANB, 2AQV, 2AGO, 2AU, 2AVL, 2AVW, 2AWY, 2AXB, 2AZH, (2BCL), 2BDB, 2BQU, (2BRZ), 2BXT, 2CAZ, 2CFP, 2CJH, (2CNN), 2CQE, 2CTZ, 2ZAE, 2KP, 2WK, 2AAS, 2AAY, 2AJH, 2AOG, 2AFA, 2AXF, 2AZE, 2BLC, 2DGO, (2DIO), 2DKY, 2DSO, 2DWN, 2DZQ, 2AN, 2AL.

Spark: (1ACO), 1ARY, 1AOK, 1BOE, 1BKQ, (1BOQ), (1BPZ), 1BRQ, 1BYX, 1CJA, 2PV, 2BL, 2BQ, 2EA, 2GN, (2EW), 2FT, 2RQ, 2AXN, 2CAZ, 2CQL, 2BK, 2UH, 2UK, 2WY, 2XI, 2ZN, 2CAN, 2GX, 2GN, 2JL.

#### 3ARN-3HS Washington, D. C.

Spark: 1AKG, 1AOK, (1ARY), 1AZK, 1BDF, 1BDC, 1BDT, (1BOQ), 1BRQ, (1BVW), 1BWY, 1CHJ, 1FS, 1GM, (1SN), 2AAF, 2ACD, 2AER, 2AHU, 2AJF, 2AQI, 2ARB, 2AWF, 2AYQ, 2BEG, 2BFX, 2CT, 2CY, 2EL, (2FP), 2MN, 2OM, 2PF, 2PV, 2SZ, 2TS, 2WB, 2ABB, 2AC, (2AJD), 2BFU, 2FP, (2HJ), (2II), 2JW, 2PU, 2QN, 2BI, (2CX), 2GM, 2ACF, 2AFA, 2AFD, 2AGO, 2AHE, 2AJX, 2ALU, 2ALW, 2ANW, 2APB, 2AQO, (2AID), (2ASL), 2AUX, (2AU), (2AXN), 2AYC, 2BAH, 2BAZ, (2BBU), 2BFY, 2BNB, (2BQA), (2BRL), 2BUN, 2CGZ, 2CKE, 2CQL, 2CZL, 2EA, (2EB), 2EO, 2EW, 2FT, 2HJ, 2JU, 2KY, 2MR, 2NO, 2RQ, 2TC, (2TY), 2UC, 2UE, 2VH, 2VQ, 2VW, (2WD), 2YN, 2ZO, 2AAW, 2AES, 2AFK, 2AJW, 2AMT, 2APK, 2BAK, 2BEN, 2CP, 2DHz, 2DIO, 2DKK, 2DMJ, 2DRR, 2DSO, 2DXT, 2DZY, 2FF, (2FK), 2GX, 2PD, 2QR, 2UH, 2ZN, 2CAN, 2GX.

C.W.: 1AJU, 1ARY, 1AYZ, 1BBW, 1BDI, 1BET, 1BGF, 1BKQ, 1BLN, 1BNT, 1BWJ, 1CGF, 1CHJ, 1HX, 1IX, 1ON, 1QP, 1XM, 1YB, 2AFP, 2AIF, 2AJA, 2AWL, 2AXK, 2BCF, 2BEH, 2BFX, 2BNZ, 2BRB, 2CCD, 2CFT, 2CMB, 2FP, 2FZ, 2NZ, 2RM, 2WR, 2AEV, 2AJD, 2BEC, 2BG, 2BHL, 2BLU, 2BNU, 2BRC, 2BUV, 2CAN, 2FP, 2FS, 2QV, 2WF, 2XW, fone, 2ZO, 2ZZ, 2GL, 2DA, 2HB, 2MA, 2EN, 2EH, 2ES, 2XAD, 2ADG, 2AGO, 2AIB, 2ALB, 2AMM, 2ANB, 2AQF, (2AU), 2AVL, (2AWP), 2AXB, 2BCL, 2BDE, 2BDU, 2BEI, 2BIL, 2BIS, 2BKH, 2BNU, 2BO, 2BRK, 2BVR, 2CI, 2CJH, 2CK, 2CKM, 2CKO, 2CNN, 2CRC, 2EA, (2EV), 2HJ, 2HM, 2JO, 2MP, 2NO, 2QY, 2SE, 2SP, 2TO, 2UC, 2UK, 2VQ, 2VY, 2YD, 2AAP, 2AIY, 2AOG, 2AXF, 2BCT, 2BDA, 2BDP, 2BTA, 2CBA, 2DGO, 2DIO, 2DZQ, 2FZ, 2PD, 2WQ, 2CAN, 2CZ, 2JL.

#### 3ZO, Parkesburgh, Pa.—Worked C.W.

1XM, 1XZ, 1BBW, 1BKQ, 1BWJ, 1CMK, 2FP, 2AXK, 2BRC, 2DM, 2EH, 2EM, 2FR, 2FS, 2IL, 2LP, 2QN, 2QV, 2ZN, 2ZS, 2ZZ, 2AAO, 2AAY, 2ABB, 2ACY, 2ADK, 2AGC, 2AGX, 2AIS, 2ALJ, 2ALN, 2ANJ, 2ASK, 2AVU, 2AVY, 2AWE, 2BLF, 2BLU, 2DV, 2EV, 2YV, 2YD, 2ZZ, 2ADG, 2BXT, 2CJH, 2UU, 2AXF, 2AN, 2CZ.

#### 3BAG, Washington, D. C.

C.W. 1AIP, 1ARY, 1AWB, 1AZW, 1BEA, 1BKQ, 1BSD, 1BWJ, 1CK, 1CM, 1CT, 1IL, 1QP, 1RD, 1UJ, 1XM, 1YK, 2AAB, 2AJU, 2AJR, 2ANZ, 2AW, 2AWL, 2AWB, 2AYV, 2AZO, 2BEA, 2BED, 2BEH, 2BEO, 2BNC, 2BQ, 2BSC, 2BTU, 2CL, 2CDD, 2CEC, 2CQ, 2FZ, 2K, 2KU, 2KV, 2NL, 2NQ.

2NZ, 2OC, 2OF, 2PZ, 2TT, 2VA, 2VH, 2XJ (fone), 2XQ, 2ZK, 2ZS, 3AAD, 3AFU, 3AJD, 3ANY, 3AQF, 3AQH, 3AQR, 3BA, 3BEC, 3BFU, 3BM, 3BP, 3BZ, 3CC, 3CG, 3CM, 3EM, 3FS, 3FM, 3HJ, 3HX, 3JX, 3PB, 3PZ, 3QV, 3QZ, 3RF, 3ZN, 3ZV, 3ZZ, 4BQ, 4BY, 4CY, 4FT, 4FV, 4GF, 4GL, 4GU, 4ID, 4IL, 4LP, 4RL, 4ZC, 5DA, 5FV, 5IL, 5PY, 5WO, 5UU, 5ACF, 5ADY, 5ADR, 5AGO, 5AGZ, 5AHV, 5AIM, 5AIO, 5AJV, 5ALV, 5AMD, 5AND, 5AOB, 5AOZ, 5ARK, 5AVB, 5AWM, 5AWZ, 5AXK, 5BC, 5BDB, 5BDO, 5BDU, 5BEL, 5BEX, 5BFX, 5BK, 5BLT, 5BO, 5BOX, 5BRL, 5BUN, 5BXA, 5BZJ, 5BZY, 5CFS, 5CK, 5CJX, 5CLD, 5CV, 5DV, 5EV, 5LW, 5OC, 5OS, 5OW, 5PO, 5QZ, 5RK, 5SF, 5UK, 5VY, 5VY, 5WY, 5XE, 5XV, 5ZB, 5ZE, 5AAS, 5AAV, 5AJA, 5AIV, 5AKD, 5AKE, 5AL, 5ALV, 5AMU, 5ARK, 5AYH, 5BRL, 5BSG, 5IH, 5IO, 5KP, 5LE, 5LQ, 5PS.

#### 4KC, Asherville, N. C. (All C.W.)

1AAW, 1ADL, 1AJE, 1APX, 1AZ, 1ARY, 1AU, 1DZ, 1FR, 1GM, 1LZ, 2AB, 2FC, 2RY, 2AJF, 2AMX, 2BSC, 2NZ, 3BA, 3RF, 3BZ, 3DM, 3FM, 3FS, 3BL, 3RW, 3TJ, 3BLF, 3CA, 3YBD, 3BHL, 3IW, 4AS, 4BY, 4CX, 4DZ, 4DC, 4EU, 4FD, 4DQ, 4CH, 4GU & spk., 4GL, 4GP, 4MI, 4MO, 5KU, 5KA, 5AM, 5DA, 5EK, 5FV, 5UU, 5GZ, 5XAD, 5BO, 7KG, 7MP, 7ZV, 8ANB, 8UG, 8CA, 8UT, 8ACF, 8AGS, 8BUG, 8BFX, 8TO, 8KH, 8BIS, 8CAY, 8ACO, 8EA, 8DU, 8ZC, 8KK, 8ASB, 9IX, 9AXF, 9UC, 9AIX, 9BW, 9ACB, 9AEY, 9BOG, 9BSG, 9DQ, 9DZQ.

#### Worked by 5KC, Plaquemine, La.

Sparks: 4CX, 4DH, 5EK, 5HB, 5IR, 5JD, 5LA, 5LB, 5NN, 5NS, 5PX, 5QA, 5QS, 5QT, 5RJ, 5SM, 5TG, 5UE, 5AAT, 5ABA, 5ABY, 5XA, 5XB, 5XI, 5XJ, 5XU, 5YG, 5YL, 5ZL, 5ZB, 5ZF, 5ZX, 5ZZ, 5ZAA, 5ZAB, 5ZAC, 5ZAE, 5ZAF, 5ZAK, 5FU, 5RY, 5WI, 5WT, 5ZY, 5ACB, 5ANQ, 5APN, 5AXU, 5BSA, 5DEH, 5DHY, 5DQ, 5DSD, 5YAE, C.W.: 5JB, 5NX, 5DZQ.

#### 5AOW, Riverside, Cal.

Spark: 5XD, 5BB, 5BK, 5BV, 5CC, 5DP, 5EA, 5EX, 5FH, 5FO, 5FP, 5GI, 5GR, 5GX, 5HC, 5HP, 5HY, 5GT, 5IB, 5IC, 5IM, 5IU, 5IV, 5JW, 5JY, 5KC, 5KM, 5LC, 5ME, 5NG, 5OD, 5OL, 5OP, 5PC, 5PJ, 5PO, 5PW, 5QK, 5QR, 5RE, 5ST, 5TF, 5TU, 5UO, 5UP, 5VK, 5VM, 5WG, 5WF, 5WR, 5XH, 5XV, 5ZD, 5ZL, 5ZQ, 5ZR, 5ZU, 5ZX, 5AAH, 5AAK, 5AAS, 5AAU, 5ABM, 5ABR, 5ABU, 5ABW, 5ABX, 5ACR, 5ADA, 5ADW, 5AEI, 5AFJ, 5AFP, 5AGF, 5AGP, 5AHF, 5AHP, 5AHQ, 5AHV, 5AHZ, 5AIF, 5AIN, 5AIT, 5AIU, 5AJH, 5AJR, 5AJW, 5AKL, 5AKT, 5ALA, 5ALD, 5ALV, 5AMK, 5AMW, 5AMZ, 5ANE, 5ANI, 5AOE, 5AOL, 5AQQ, 5AQS, 5AQU, 5AQX, 5AQY, 5ARD, 5ARK, 5ASB, 5ASK, 5ATF, 5AUD, 5AVE, 5AVD, 5AVM, 5AVE, 5AWI, 5AWX, 5AWY, 5ZAE, 5ZAM, 5BAJ, 5BAK, 5BBC, 5BBK, 5BBO, 5BBV, 5BBD, 5BCS, 5BDW, 5BEA, 5BEM, 5BEO, 5BEP, 5BFE, 5BFH, 5BGH, 5BGL, 5BK, 5BIN, 5BIP, 5BIU, 5BJD, 5BJV, 5BJX, 5BKB, 5BKS, 5BMP, 5BNN, 5BOL, 5BVK, 7CK, 7LN, 7LY, 7MF, 7GV, 7GJ, 7BR, 7FJ, 7FI, 7JL, 7JD, 7NF, 7OT, 7TO, 7TU, 7WG, 7YA, 7ZK, 7ZU, 7ZP, 7ZJ, 7ZM, Canadian 9BD, CL-8.

C.W.: 5ZA, 5AK, 5CU, 5DF, 5EA, 5EB, 5EC, 5EN, 5FT, 5GD, 5GL, 5GY, 5HJ, 5JD, 5KC, 5KU, 5KY, 5KA, 5NX, 5RR, 5TI, 5VM, 5ZA, 5ZB, 5ZE, 5ZF, 5ZG, 5PI, 5ZI, 5ZN, 5ZS, 5ZX, 5ZZ, 5AAG, 5AAT, 5AAV, 5AGH, 5AGP, 5AIB, 5AIF, 5ALU, 5ALV, 5AOZ, 5AGU, 5APO, 5ARO, 5ASJ, 5ASV, 5AVD, 5AWP, 5AWT, 5AWV, 5AWX, 5XAD, 5XAF, 5XAG, 5ZAA, 5ZAK, 5BBC, 5BCB, 5BCD, 5BEG, 5BEQ, 5BFE, 5BGE, 5BG, 5BGQ, 5BJC, 5BJR, 5BJQ, 5BLA, 5BLV, 5BNJ, 5BQE, 5BZA, 7HT, 7QT, 7XG, 7ZU, 8VY, 8AGZ, 8BUM, 9PI, 9PS, 9WD, 9WU, 9AMB, 9AYU, 9XAG, 9ZAF, 9BAZ, 9DTM, 9DVA, 9BJL, 9DVJ, DD-5, CL-8, Canadian 4CB, 9BD.

Fone: 5AK, 5DF, 5GD, 5KY, 5ZN, 5AAG, 5AAT, 5AIB, 5APO, 5BG, 5BJR, DD-5, FY-E.

#### Can. 5DK, at Pasadena, Cal.

Spark: 5AJ, 5AM, 5AT, 5BH, 5BJ, 5BK, 5BR, 5BV, 5DA, 5DD, 5DZ, 5EA, 5EK, 5ES, 5FF, 5FT, 5IS, 5LC, 5LK, 5OG, 5RR, 5SK, 5UT, 5WC, 5WL, 5AAU, 5ACV, 5AIT, 5ALO, 5ALU, 5AMY, 5APC, 5AQU, 5AQV, 5AQX, 5BAR, 5BBD, 5BEB, 5BEO, 5BET, 5XAD fone, 5ZK, 5ZZ, 5ZF. All of above heard on crystal. Following with one tube.

Spark: 5IF, 5XF, 5ZA, 5ZF, 5AH, 5GT, 5KM, 5OH, 5BV, 5HK, 5PO, 5PR, 5TU, 5APE, 5APP, 5AUU, 5BUM, 5BAJ, 5CK, 5KH, 5KJ, 5YG, 5YS, 5ZT, 5DVA, 5DZL.

C.W.: 5LA, 5ZA, 5ZX, 5CU, 5EB, 5EN, 5IR, 5KA, 5KY, 5OX, 5SK, 5OP, 5UM, 5WA, 5ALE, 5AWT, 5ANZ, 5ARF, 5ATB, 5DP, 5NX, 5ZU, 5VV, 5DVI.

#### 5AJR, Reno, Nevada

Spark: (5AS), 5BD, (5BV), (5CZ), (5CC), 5DD, 5DS, 5DP, (5EA), 5EC, (5EX), 5FN, 5FH, 5GZ, (5GR), (5GF), (5GP), (5GT), (5HC), 5HP, (5IB), (5IC), (5IV), 5KC, (5KE), (5LC), 5LU, (5LO), 5NG, 5OD, (5OL), (5PJ), (5TU), 5UP, (5UQ), (5VK), (5VX), 5WP, 5ZE, 5ZU, 5ZQ, 5AAB, (5AAK), (5AAU), 5ABO, (5ABU), (5ABW), (5ACR), 5ACV, 5ADA, (5AEH), (5AHV), 5AHQ, 5AIN, 5AIU, 5AIX, (5AJH), (5AIA), (5ALD), (5ALV), (5ALW), (5AMK), 5AMW, 5ANI, 5AOL, 5AOR, 5AQY, (5AQU), 5AQV, (5AQX), 5ARK, 5ARM, 5ARE, 5ATF, 5ATU, 5AUD, 5AUP, 5AAU, 5AVB, 5AVE, 5AVX, 5AWX, 5BAJ, (5BAK), 5BDQ, 5BDW, (5BEM), 5BFR, (5BGL), (5BMP), 5BNN, 5BQN, (5TB), (5BK), (5BH), 7EO, 7FR, (7GE), 7JD, 7KJ, 7MF, (7NN), 7NW, 7NZ, (7OT), 7QO, 7BC, 7TO, 7VE, 7VZ, 7WG, 7YA, 9AQE, 9DSD, Can. (9BD).

C. W.: 5AK, 5BK, (5CU), 5DF, (5EA), (5HF), 5EN, (5FT), 5GD, (5JD), (5KA), 5KL, 5KU, 5NX, 5OO, (5RR), 5TI, 5UO, 5XAD, 5ZB, (5ZF), (5ZI), (5ZO), (5ZX), 5AIY, 5ALU, 5AOT, 5ASJ, 5ATG, (5AWT), (5BES), 5BJQ, (5BKB), 7DP, 7QW, 7WD, 7WU, 7PI, 9AMB, 9AYU, 9BJL.

#### 5ALD, Pasadena, Calif.

Spark: (5AAK), 5AAU, (5ABU), (5ABW), 5ADA, (5AEH), 5AHF, 5AHU, (5AIN), 5AIO, (5AJH), (5AJR), (5ALA), 5AMK, 5AOL, (5AOR), 5APE, 5APO, (5AQU), 5AQY, (5ARK), (5AS), (5AUD), (5AVM), (5AVX), (5BGL), (5CC), 5CZ, 5DP, (5EX), 5FH, (5GF), (5GR), (5GT), (5HP), 5IB, (5IC), (5IV), (5KC), 5LU, 5NG, 5PJ, 5TC, (5TU), 5VK, (5VX), (5XH), 5ZG, 5ZQ, (5ZU), 7BK, (7MF).

C.W.: 5NX, 5QY, 5TW, 5ZAA, 5ZB, 5ZX.

#### 7WG, Newport, Idaho

Spark: 5AF, 5BD, (5CC), 5DP, 5GR, 5IL, 5IN, 5JR, 5KQ, 5LC, 5TU, 5ZQ, 7BH, 7DH, (7FI), 7GE, (7JF), 7MF, 7NZ, (7NL), (7OT), 7VO, 7ZV, 9BD, 9WZ, 9AUU, 9AVZ.

C.W.: 5AK, 5DX, 5EN, 5KA, 5NX, 5PI, 5SG, (5ACR), 5AKK, 7ZU, 7WQ, 9AMB, 9DKY, 9DTM, Phone: 7FL, 7ZU.

#### 7SN, Seaside, Oregon

Spark: 5CC, 5EX, 5EB, 5FH, 5GR, 5IC, 5IM, 5KM, 5KV, 5LK, 5LC, 5PO, 5TV, 5VK, 5XH, 5ZQ, 5AUW, 5ALA, 5ARK, 5AJR, 5AVM, 5AAU, 5AZU, 5AKT, 5AGF, 5ALW, 5AMK, 5APE, 5CV, 7ED, 7GE, 7HQ, 7JD, 7KE, 7LY, 7MU, 7MF, 7NN, 7NW, 7NZ, 7OT, 7TO, 7VN, 7VO, 7WG, 7YA, 7YS, 7YM, 7ZK, 7ZM, 7CL, Can. 9BD.

C.W.: 5ZA, 5CU, 5EN, 5FT, 5GY, 5KU, 5OO, 5SU, 5SG, 5TL, 5VM, 5ZF, 5ZI, 5ZN, 5ZX, 5AAT, 5AGU, 5AWV, 5AIV, 5AWT, 5BKB, 5BCD, 5XAD, 5ZAC, 7DP, 7FI, 7MF, 7NF, 7BR, 7ZU, Can. 5CT, Can. 4OB.

#### 5AUU, Canton, Ohio

Spark: 1AW, 1AOK, 1FT, 1PR, 1YB, 2ARB, 2BFX, 2BRC, 2CA, 2FP, 2GP, 2OM, 2PO, 2RP, 2WB, 3ACK, 3AW, 3BFU, 3FD, 3HJ, 3VS, 4CX, 4GU, 4GX, 4HS, 5ZA, 7FU, 5AFD, 5APB, 5ARB, 5AYC, 5AMQ, 5AL, 5AU, 5BWH, 5BEG, 5BDV, 5BKE, 5BBU, 5CDM, 5CDH, 5CKV, 5CEB, 5CQL, 5QAM, 5COM, 5DY, 5EA, 5EB, 5EO, 5EW, 5EX, 5FG, 5FI, 5FS, 5FT, 5JP, 5JU, 5LF, 5KY, 5NO, 5OZ, 5RC, 5RG, 5TC, 5TO, 5TP, 5UC, 5VC, 5VL, 5VW, 5XAK, 5XAE, 5YN, 5ZA, 5ZO, 5ZX, 5ZY, 5ZZ, 5AKT, 5AMT, 5APM, 5AAY, 5AAM, 5ALH,

9AAW, 9AQA, 9AMF, 9ALP, 9APS, 9BAK, 9BDK, 9CPD, 9CA, 9CP, 9DMI, 9DSO, 9DFX, 9DMJ, 9DQD, 9DEV, 9DYX, 9DI, 9DZ, 9EH, 9JX, 9LF, 9MC, 9PD, 9TX, 9UH, 9US, 9XE, 9YB, 9ZN.

C.W.: 1AV, 1AZW, 1ASF, 1ARY, 1AUN, 1ADL, 1AZK, 1AIP, 1BMJ, 1BKQ, 1BWJ, 1BQY, 1BKQ, 1BKA, 1BDC, 1BTW, 1BZX, 1BJA, 1BRQ, 1BGF, 1BDI, 1CMK, 1CHA, 1CIK, 1CNR, 1CMM, 1CAS, 1CAK, 1EE, 1FW, 1IX, 1QP, 1QC, 1WC, 1XX, 1XY, 1XZ, 1ZE, 1ZN, 2ANM, 2AYV, 2AIF, 2AFP, 2AXK, 2AJA, 2AWF, 2BCF, 2BDX, 2BQH, 2BNZ, 2BEH, 2BLI, 2BCF, 2BRD, 2BRC, 2BFM, 2BDM, 2BJY, 2BEA, 2BEF, 2BQU, 2BFX, 2BUA, 2BUM, 2BNQ, 2BFQ, 2BDG, 2BAG, 2BLP, 2BFK, 2BHJ, 2BUC, 2BLR, 2BUX, 2BE, 2CBG, 2CEN, 2CCD, 2CWE, 2CFE, 2CCX, 2COC, 2CFT, 2FH, 2FP, 2GF, 2LP, 2NZ, 2PJ, 2RC, 2TJ, 2UD, 2VC, 2WR, 2XV, 3AAY, 3ASV, 3ADX, 3ALN, 3ANY, 3AIS, 3AYY, 3AW, 3BJJ, 3BLF, 3BQH, 3BHL, 3BNU, 3BLR, 3BFG, 3BFF, 3BAV, 3BZ, 3CLF, 3CZP, 3CBM, 3ZG, 3CZ, 3FA, 3FP, 3FQ, 3FS, 3GC, 3GP, 3HD, 3HG, 3HW, 3IM, 3IW, 3LR, 3PB, 3QV, 3RF, 3SF, 3SJ, 3TJ, 3VV, 3WF, 3ZZ, 4AL, 4BQ, 4CF, 4CQ, 4DC, 4DF, 4DH, 4DS, 4EB, 4EA, 4FS, 4GE, 4GH, 4GL, 4ID, 4IV, 4KA, 4KC, 4LP, 4ZE, 4ZH, 5AAM, 5AJ, 5DA, 5DR, 5EW, 5FE, 5JB, 5KU, 5LA, 5LJ, 5MA, 5VL, 6GL, 6HD, 6ZAC, 6ZZ, 7CG, 7GP, 7IV, 7LY, 7OP, 7WO, 8AVA, 8ADG, 8ACF, 8AUX, 8AQZ, 8AXC, 8AWP, 8ARI, 8AU, 8AVD, 8AWR, 8AIO, 8ARG, 8AXB, 8ANB, 8AGO, 8AMD, 8AFD, 8ASH, 8AQF, 8AMF, 8AAM, 8APL, 8ALB, 8APW, 8ALF, 8AQG, 8AWM, 8AYW, 8AST, 8ASM, 8AGK, 8ARO, 8AQF, 8AWW, 8AZH, 8AFK, 8ABQ, 8AVW, 8BQF, 8BXF, 8BLF, 8BQU, 8BRL, 8BDU, 8BXH, 8BYC, 8BGG, 8BDU, 8BDB, 8BTP, 8BOX, 8BXH, 8BMF, 8BUV, 8BEL, 8BIN, 8BNE, 8BIT, 8BUX, 8BXH, 8BNZ, 8BLW, 8BNT, 8BKF, 8BLX, 8BCF, 8BJU, 8BGF, 8BIL, 8BU, 8BO, 8CGM, 8CAY, 8CTP, 8CKO, 8CGZ, 8CBG, 8CJH, 8CPI, 8CWH, 8CFG, 8CGM, 8CON, 8CQL, 8CFO, 8CIA, 8CMI, 8CFC, 8CFP, 8CGX, 8CCM, 8CKD, 8CFC, 8CKM, 8CUH, 8DH, 8DV, 8DZ, 8EA, 8EO, 8FK, 8GV, 8HJ, 8HM, 8HW, 8JM, 8JQ, 8JU, 8KH, 8LB, 8LF, 8PI, 8PT, 8QC, 8QZ, 8SE, 8TO, 8SP, 8TJ, 8UC, 8UE, 8UK, 8UU, 8VR, 8VV, 8VY, 8VZ, 8VQ, 8WN, 8WR, 8XE, 8XG, 8YD, 8YM, 8ZC, 8ZG, 8ZL, 8ZW, 8ZAE, 8AUA, 9AXF, 9AAF, 9APM, 9ARK, 9AJA, 9AMF, 9AJX, 9AJH, 9AAY, 9AIV, 9APH, 9AIX, 9AXN, 9AFS, 9AGJ, 9AAG, 9AOY, 9AFT, 9ATW, 9AOG, 9AKD, 9AKM, 9AJH, 9AWK, 9AKD, 9AYU, 9AL, 9BLW, 9BHD, 9BUD, 9BDB, 9BGE, 9BLO, 9BFD, 9BED, 9CBA, 9CHA, 9DZQ, 9DFN, 9DQG, 9DIO, 9DCR, 9DFB, 9DKQ, 9DAX, 9DUG, 9DKY, 9DIX, 9DYN, 9DV, 9EL, 9EO, 9FE, 9FZ, 9GL, 9II, 9IO, 9JG, 9KP, 9LQ, 9PI, 9PF, 9QF, 9JF, 9SF, 9UU, 9UV, 9WA, 9XI, 9YAM, 9XAJ.

#### SBIL, Warren, Pa.

C.W.: 1AGI, 1AIP, 1ARY, 1AWB, 1BAS, 1BBW, 1BDI, 1BKQ, 1BQE, 1BUA, 1BWJ, 1CHJ, 1CJH, 1CNR, 1IV, 1IX, 1JT, 1PR, 1QP, 1VQ, 1XM, 1XX, 2AFP, 2AJF, 2AWF, 2AWL, 2AXK, 2AYV, 2BBX, 2BEA, 2BGJ, 2BLP, 2BNZ, 2BQH, 2BQU, 2BRB, 2BTJ, 2CEN, 2CMB, 2CT, 2CWE, 2FP, 2KL, 2NZ, 2RY, 2WR, 3AAO, 3AAY, 3ADX, 3AIS, 3AJD, 3ALL, 3ALN, 3ANJ, 3ARD, 3AVY, 3BA, 3BAG, 3BEC, 3BG, 3BHL, 3BJJ, 3BLF, 3BLU, 3BRI, 3BUR, 3BUV, 3CA, 3CG, 3FP, 3FQ, 3FS, 3IW, 3LR, 3PB, 3RV, 3WF, 3ZO, 3ZZ, 4GL, 4GX, 4ID, 4KC, 4LP, 5DA, 5EK, 5KU, 5LJ, 5ADG, 8AGO, 8AGR, 8AIO, 8ALB, 8AM, 8AMM, 8AMQ, 8AQF, 8AQO, 8AQZ, 8ASM, 8AVD, 8AVL, 8AWM, 8AWP, 8AXB, 8BCF, 8BDE, 8BDO, 8BDU, 8BEI, 8BEO, 8BEK, 8BFX, 8BKE, 8BO, 8BOX, 8BRW, 8BVR, 8BXH, 8BXT, 8CAY, 8CFG, 8CFS, 8CJH, 8CKM, 8CKO, 8CMM, 8DV, 8HM, 8KH, 8NE, 8OC, 8PT, 8QB, 8QC, 8SE, 8TO, 8UC, 8VQ, 8VY, 8WA, 8XE, 8AAP, 9AIY, 9AJH, 9ARK, 9BED, 9BQW, 9BUD, 9BVP, 9CBA, 9CCS, 9BDB, 9DCR, 9DGG, 9DIO, 9DKH, 9DWJ, 9DZQ, 9EI, 9FZ, 9IO, 9JR, 9LQ, 9UU, 9WA, 9XI.

#### SAUX, Cleveland, Ohio

1AJ, 1AW, 1RH, 1XZ, 1ADC, 1ADL, 1ARB, 1ARY, 1BQ, 1BUA, 2BM, 2EL, 2FP, 2OM, 2RM, 2WB, 2ACD, 2AHU, 2AHW, 2AJE, 2ARB, 2BEH, 2CDZ, 3AC, 3BA, 3BP, 3CC, 3EZ, 3FP.

3GX, 3UC, 3ZO, 3ZY, 3ABB, 3AJD, 3ALN, 3AOV, 3AYV, 3BJJ, 3BSH, 3BFU, 3BLF, 3CX, 4EA, 4FD, 4GL, 4GN, 5DA, 5HK, 5PY, 5KA, 5BO, 8DY, 8EB, 8EO, 8EW, 8FT, 8FV, 8KY, 8LB, 8LF, 8MZ, 8NO, 8OC, 8RT, 8SP, 8TY, 8UE, 8UO, 8VQ, 8VY, 8UC, 8WD, 8YN, 8ZE, 8ZO, 8AFB, 8AFD, 8AFE, 8AHQ, 8AJW, 8AGO, 8AJX, 8AKQ, 8AMZ, 8ANO, 8AOI, 8AQO, 8ARS, 8ASL, 8AWU, 8AYC, 8AYM, 8AZF, 8BCF, 8BBU, 8CGZ, 8CEB, 8CP, 8FP, 8KI, 8KX, 8LF, 8MC, 8OX, 8PD, 8RC, 8SN, 8UH, 8UU, 8VL, 8YB, 8YJ, 8ZC, 8ZN, 9AAU, 9AAW, 9ACB, 9AFK, 9AGR, 9AIU, 9AIR, 9ARK, 9AVV, 9AWZ, 9AZE, 9AZF, 9BHD, 9BIQ, 9DCX, 9DEN, 9DFX, 9DLX, 9DKK, 9DRR, 9DZY.

#### SAGO, Pittsburgh, Pa.—All C.W.

(1IX), 1PR, 1AJU, 1AZW, 1BBW, 1BDI, 1BGF, 1CHJ, 1CJH, 1CKA voice, 1CNR, 2BG, 2NZ, 2VW, 2WR, 2XQ, 2ZK voice, 2AFP, 2AJA, 2AYV C.W. & I.C.W., 2AZY, 2BDG, 2BEA, 2BEH, 2BFX, 2BGX, 2BLP, 2BQH, 2BRC, 2BTJ, 2CCD, 2CES, 2CFE, 2CWE, 2BA, 2FS, 2FP, 2HG, 2IW, 2LR, 2PB, 2QV, 2TJ, 2VW, 2WF, 2ZO, 2ZZ, 2ADX, 2ALN, 2ANJ, 2ANY, 2AQH, 2ATF, 2AVY, 2BHL, 2BJJ, 2BLF, 2BUP, 2CAQ, 2DC, 2EN, 2GH, 2GL, 2IY, 2KC, 2LP, 2BH, 2HB, 2KU, 2LJ, 2RL, 2WO, 2WR, 2ABM, 2AAM, 2AM, 2BO C.W. & I.C.W., 2BP, 2EA, 2HM, 2HJ, 2KH, 2LB, 2MP, 2QB, 2SE, 2UC, 2UE (I.C.W.), 2UK, 2VG, 2VY, 2XE, 2XG, 2ZG, 2ZZ, 2ALB, 2ALT, 2AMA, 2AMQ, 2ANB, 2AQC, 2AQF, 2AQZ, 2ARW, 2ASM, 2ASO, 2AVD, 2AVT, 2AVW, 2AWM, 2AXB, 2AXC, 2BCF, 2BDB, 2BGG, 2BIS, 2BJC, 2BLX, 2BMM, 2BPI, 2BRZ, 2BUX, 2BWK, 2BXH, 2CAY, 2CAZ, 2CJH, 2DV, 2EI, 2IL, 2IL, 2JR, 2KP, 2MC, 2UC, 2UU, 2WA, 2XI, 2YI, 2AAP, 2AAY, 2AIY, 2AJH, 2AKD, 2AOG, 2APG, 2ARK, 2AXF, 2BBA, 2BBF, 2BDE, 2BED, 2BHD, 2BHQ, 2BRL, 2BVP, 2CEA, 2DAX, 2DGG, 2DKY, 2DXK, 2DZQ, 2Can, 2BV, 2CZ).

#### SASL, Fredonia, N. Y.

Spark: 1BOQ, 1LZ, 2AAN, 2AHU, 2ARB, 2BFX, 2BSC, 2EL, 2FP, 2WB, 2ABB, 2AC, 2AJD, 2ARN, 2BJ, 2CL, 2FP, 2PU, 2EA, 2ACF, 2AHQ, 2AIJ, 2AJ, 2ARD, 2AUG, 2AU, 2AXQ, 2AYM, 2BAZ, 2BBU, 2BDA, 2BFY, 2BK, 2BM, 2BPG, 2BQA, 2BSB, 2BSF, 2BXC, 2BWC, 2CAS, 2CDV, 2CEB, 2CEJ, 2EA, 2EO, 2EW, 2JU, 2KY, 2MU, 2TC, 2VH, 2VI, 2VQ, 2ZO, 9AAW, 9AES, 9AFK, 9AGR, 9AMT, 9APS, 9AZE, 9BSC, 9DKK, 9DZY, 9FK, 9PD, 9UH, 9XI, 9ZN, 2Can, 3GX).

C.W.: 1ADL, 1ARY, 1BBW, 1BDI, 1BKA, 1BKQ, 1BUA, 1CAK, 1CNE, 1CNR, 1HQ, 1PR, 1XZ, 2ADX, 2AFP, 2APA, 2AWF, 2AYV, 2BDG, 2BEH, 2BG, 2BGJ, 2BQH, 2BQU, 2CEN, 2CFT, 2FP, 2VC, 3AAO, 3ANY, 3AQH, 3AWH, 3AXE, 3BEC, 3BLF, 3IL, 3IW, 3QV, 3VW, 3WF, 3XW, 4BQ, 4DC, 4GX, 5DA, 6KA, 8ABO, 8ADU, 8AGO, 8AGR, 8AIJ, 8AIO, 8AJY, 8ANB, 8ANJ, 8APT, 8AQF, 8AQZ, 8AUH, 8AU, 8AVL, 8AWM, 8AWP, 8AXB, 8AXC, 8AYB, 8BCL, 8BDU, 8BEF, 8BEL, 8BJU, 8BLX, 8BRC, 8BRM, 8BUX, 8BXT, 8BZF, 8CAJ, 8CAY, 8CBJ, 8CGM, 8CKM, 8CKO, 8CLJ, 8CNU, 8CON, 8HJ, 8KH, 8KU, 8ND, 8QB, 8QZ, 8UE, 8VQ, 9BED, 9BLC, 9BTA, 9LQ, 9XI, 2Can, 3JI, 3QV.

#### SCCW, St. Louis, Mo.

C.W.: 1RU, 1AFV, 1ARY, 1CAK, 1XM, 2EL, 2FD, 2FT, 2UF, 2KP, 2WF, 2XB, 3FB, 4BK, 4BQ, 4CO, 5HK, 5UU, 5XB, 6ZZ, 8CL, 8DX, 8HM, 8IL, 8LF, 8LU, 8NQ, 8QX, 8XK, 8ZG, 9EL, 9IO, 9KP, 9LQ, 9WA, 9YU, 9AAP, 9AAS, 9AAU, 9ACB, 9AJA, 9AKR, 9AMB, 9DDY, 9BEO, 9BIZ, 9DYE, 9DZW, 9XAC, 9YAM, 2Can, 3BP.

Spark: 1AW, 1SN, 1AKG, 1AWZ, 1BSI, 2WL, 2EL, 3IW, 3UC, 4BQ, 4DH, 4JB, 5AA, 5HY, 5AI, 5ER, 5FO, 5MF, 5QA, 5TD, 5UU, 5XU, 5BP, 5DW, 5ER, 5FI, 5FT, 5GO, 5HM, 5JJ, 5ZL, 5ZS, 9AP, 9AU, 9BF, 9CA, 9EE, 9ET, 9FS, 9HM, 9JN, 9JM, 9KO, 9LW, 9ME, 9MS, 9PN, 9RC, 9YD, 9YO, 9ZN, 9AAP, 9ACB, 9AEG, 9AFF, 9AGE.

9AHE, 9AIG, 9AJZ, 9AMA, 9AMT, 9AOU, 9BDF, 9BIC, 9BCX, 9BSA, 9BSO, 9BYF, 9CEE, 9DMW, 9DQR, 9DYY, 9DZY.

**9AHC, Ellendale, N. Dak. (Single Tube)**

C.W.: 2FP, 4GL, 4LP, 5AAC, 5AAM, 5DO, 5EK, 5KU, 5LJ, 5TJ, 5YG, 5ZAT, 6KA, 6XAD, 7HS, 7ZO, 8ABO, 8AGO, 8AIO, 8ALB, 8AMM, 8AQF, 8ARW, 8ASB, 8AU, 8AWP, 8AXB, 8AXC, 8BCF, 8BDO, 8BKE, 8CAZ, 8CFC, 8CKM, 8EA, 8EB, 8KH, 8LB, 8MP, 8OZ, 8PT, 8SE, 8TO, 8UC, 8UK, 8VY, 8WA, 8XAK, 8YD, 9AFD, 9AFN, 9AFU, 9AGN, 9AIF, 9AII, 9AJA, 9AJH, 9AMB, 9AMI, 9AOG, 9APW, 9ARK, 9ARZ, 9ASF, 9ATN, 9AUA, 9AYU, 9BAF, 9BAV, 9BBF, 9BDP, 9BED, 9BGH, 9BHD, 9BHQ, 9BIK, 9BJI, 9BOW, 9BQW, 9BRL, 9BTA, 9BUN, 9BXA, 9CAO, 9CBA, 9CBB, 9CCS, 9DCG, 9DCU, 9DIO, 9DKY, 9DOL, 9DR, 9DSM, 9DTM, 9DUG, 9DUN, 9DYN, 9DZQ, 9EI, 9FP, 9FZ, 9GL, 9IO, 9KP, 9QF, 9UN, 9UU, 9VE, 9WA, 9WD, 9WQ, 9XAK, 9XI, 9YAJ, 9YF, 9ZL.

Fones: 9SF, 9PI, 9YAE.

Spark: 5MF, 5QS, 5EB, 8YN, 9AEG, 9AEY, 9AFK, 9AIG, 9AKX, 9ANF, 9ARG, 9AUA, 9AUL, 9AUU, 9AVX, 9AVZ, 9BDF, 9BKP, 9BOF, 9BRI, 9BKK, 9DMJ, 9DZY, 9FX, 9LF, 9OX, 9TI, 9TV, 9XI, 9XT, 9YAK.

**9BHD, Warren, Illinois**

C.W.: 1ARY, 1AXK, (1BBW), 1BKQ, 1CNR, 2AFP, 2AYV, 2BEH, 2BFX, 2CCD, 2FP, 2NZ, 3ALN, 3BLF, 3BSL, (3FS), 3HG, (3IW), 4BQ, 4DF, 4GX, 4LP, 4ZB, (5AAC), (5DO), (5EK), (5KU), (5LJ), (8AGO), (8AIG), 8AIO, (8ALB), (8ANB), (8AXB), 8AZS, (8BKE), (8BRL), (8CAY), (8CAZ), 8CIB, (8CJH), (8CUA), 8EA, 8HM, (8KS), (8UK), (8VY), (9AAV), (9AFB), (9AFN), (9AIF), (9AII), 9AJA, (9AJH), (9AOG), (9APW), (9ARK), (9ARZ), 9AUA, (9AXF), (9BAF), (9BAV), (9BBE), (9BGH), (9BIQ), (9BQW), (9BRL), (9BSG), (9BTA), (9CCS), (9CHA), (9DCR), (9DKP), (9DWY), (9DZW), (9DZQ), (9EI), 9PS, 9PN, (9UU), 9XI, Can. 8CZ.

Spark: 5NS, 8BEP, 9AKU), (9AZA), (9BUO), (9CDB), (9DRS), (9DVX), (9DXT), (9DZU), (9DZY), (9FK), (9GC), (9UG).

**9APW, St. Paul, Minn.**

C.W.: 2FP, 2BEH, 2BUQ, 3AGC, 3ALN, 3CZ, 4BQ, 4GX, 5EK, 5KU, 5LJ, 5YG, 6EN, 6KA, 7ZU, 8BO, 8CJ, 8EA, 8JU, 8OZ, 8QC, 8UC, 8UK, 8VE, 8VQ, 8YD, 8AIO, 8ADG, 8AGO, 8ALB, 8AQZ, 8ANB, 8AWM, 8AXB, 8BEF, 8BEL, 8BFX, 8BVR, 8BRW, 8CAY, 8CBB, 8CFC, 8ZAG, 9DV, 9EI, (9FZ), 9KP, 9IO, (9QF), (9PS), 9UU, 9VE, 9WU, 9YF, 9ZB, 9AFD, 9AFN, 9AFU, (9AII), 9AJA, 9AJH, 9AMI, (9AMT), (9AOG), 9AOR, 9APE, 9ARI, 9ARK, (9ARZ), 9ATA, 9ASF, 9ATN, 9AXF, 9AYU, (9BAF), (9BBF), (9BCT), 9BDP, (9BED), 9BGH, (9BHD), 9BHQ, 9BIQ, 9BJI, (9BJZ), 9BLC, 9BLO, 9BOW, 9BQW, 9BSG, 9BTA, 9BVP, 9CBA, 9CBV, 9DAX, (9DBL), 9DCU, 9DKY, (9DIO), 9DQL, 9DUG, 9DVJ, (9DWY), (9DZQ), 9DZJ, (9YAJ).

Spark: 5ABY, 7ZV, 8EA, 8EB, 8UC, 9HG, (9IG), 9MC, 9UU, 9XT, 9ZC, 9ZN, 9AAW, 9ABV, 9AEY, 9IG, 9AIF, 9LF, 9AXU, (9AVZ), 9BKP, (9BOF), 9DKK, 9DMJ, 9DUG, 9DZY, 9DSO, 9DXT, 9DQG, 9YAK.

**9AOG, Lawrence, Kansas**

C.W.: 2FP, 4EB, 4ZB, 5EK, (5HB), 5IC, 5KU, (5LJ), (5NK), (5OI), (5PB), 5SF, (5ZAT), 6BES, 6EN, 6KA, 3AGO, (A8LB), 8ANB, 8ASW, 8AU, 8AWM, 8AXB, 8BDO, 8BDU, (8BEI), 8BO, 8BXF, (8DV), 8EA, 8GY, (8HJ), 8SE, 8UC, 8UE, 8UK, 8VQ, (8VY), 8XJ, 9AAP, 9ABF, 9AFB, 9AFN, 9AIF, 9AII, 9AJA, (9AKD), (9AMB), 9AMT, 9AMW, (9APW), 9ARI, 9ARK, (9ARZ), 9ATN, 9ATU, (9AUA), 9AVM), 9AX, 9AXF, (9AYU), 9AZM, 9BAA, (9BAF), 9BBA, (9BBF), 9BDN, (9BED), (9BEM), 9BEY, (9BGH), (9BHD), (9BIW), 9BJE, 9BKK, 9BOA, 9BQW, (9BSG), (9TA), 9BUD, (9BXI), (9CBA), (9CCS), (9DGG), 9DQG, (9DIO), (9DKX), 9DKY, 9DNG, (9DSM), (9DTA), 9DTM, 9DTS, 9DUG, 9DUN, (9DWY), (9DXD), (9DZQ), 9EI, (9EL), 9FM, (9FZ), 9IF, 9IO, 9JG, 9LQ, 9OF, 9PN, 9PS, 9QF, (9SJ), (9UU),

(9VE), (9WA), (9WD), 9XAK, (9XI), (9YAJ), 9YI.

Spark: (5ABY), 5ADU, (5IR), 5LB, 5NC, (5NS), 5QL, 5SM, 5TC, 5TU, 8BBU, 8EA, 8UC, 8WU, (9AAW), (9ABV), 9AEG, (9AEY), 9AFK, 9AHZ, 9AIF, 9AMT, (9ANO), 9ANP, 9APK, 9APN, 9APS, 9AQZ, 9ARG, 9AUA, 9AVH, 9AVZ, (9AYL), 9AZE, 9AZF, (9BGI), (9BHN), 9BKK, 9BLW, (9BPK), 9BSC, (9BSZ), 9BZJ, (9DGV), (9DJB), 9DJX, (9DKK), 9DMJ, 9DPB, 9DRQ, 9DRW, (9DVF), 9DXE, 9DYC, (9FK), 9KA, 9LF, 9MC, 9NQ, 9OX, 9PD, 9PW, (9RR), 9SY, 9XI, 9XT, 9YJ, 9ZH, (9ZN).

## AMATEUR RADIO IN PORTO RICO

(Concluded from page 38)

of course, but our native tongue is Spanish. This alone is a strong link in the chain we are forming in our efforts to reach our South American brothers. They, too, are of the Castilian race, and it is our duty to bring them together and give them the enlightenment our North American brothers have.

Remember, Brothers, we are all Americans, whether we come from Northern Hemisphere or the Southern. "The United States of Brazil" or the "United States of Argentine" sounds just as much to a native of that clime as the phrase "The Good Old U.S.A." sounds to you, and we all have the same liberty-loving ambitions. Therefore, we are going to be with you in the radio game, as we are with you in all others. It is our ambition to join you in making the history of the radio world, that your signals may be carried not only east and west but north and south from Pole to Pole; not only will the cry be "from Pekin to the Hague", but "from Buenos-Aires to Pekin and the Hague"!!

Well, we guess that is saying a pretty big mouthful, but when Paul Godley bit off the "Trans-Atlantic" bite and more than gulped it down, why can't we, with just about half the distance to cover over water, the other by live radio stations, complete another link in the ever-growing chain of citizen radio, throughout the world?

Now, all you "four" stations get busy, and also the "fives"—we want to hear from you. Now is the time to start on your next season's plans. We will be with you then, with more than one squeak-box, too. So from now on we will do a little research on underground antennas, elimination of static and strays, and once in a while catch a few words of your never-ceasing signals. "Adios", brothers, but we are with you on the air.

## HOWARD F. MASON

(Continued from page 49)

part of the country for being on the job steadily. He is not much on all-night watches but except for two periods of two weeks each, he has not missed a night in the past year and a half. He handles

(Concluded on page 69)

# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents.



## Expert Advice

Detroit, Mich.

Editor, QST:

The broadcasting situation is becoming more critical than the adjustment of a bare-point electrolytic detector. Lectures on every known and unknown subject have exhausted the supply of material from that source, while every schoolboy has memorized all available grand opera—also the other kind; we know by heart all the possible combinations of "Mammy" and the southern paradise that someone is pining his heart away for, yet for some reason or other prefers to stay in our midst and fill the air with his plaintive lament. Jazz has crusted our plates so thoroughly that the tubes refuse to syncope and it really seems that it is up to someone to discover some new fuel to keep the steam rollers going twenty four hours a day.

The writer knows personally a man who is unable to tune in anything in the way of instruction or amusement on his stick-pin set while on his way to work via trolley. This condition I find is due to the fact that he travels at six A.M. and broadcasting does not start until 9. Could not this interval be bridged by broadcasting the ticking of the City Hall clock or the roar of Niagara? Surely, American ingenuity can find something necessary to the welfare of the public that would lend itself to the radiophone! The two noises suggested would be very desirable, in my opinion, as any amount of distortion would not seriously impair their usefulness when projected bodily from a "loud-speaker." This would also tend to still further discourage those dot-and-dash experimenters who have sprung up in such numbers since the invention of radio by our local newspaper.

If wireless interferes with radio, why, something must be done about it. The most powerful receiving sets purchased from the various malt and hop stores, and recommended by their experts as being equipped with all latest improvements such as single slide tuning coil, coherer detector, 1000 volt phones and ten feet of tested aerial wire, are subject to this annoyance. Many purchasers have erected higher aerals in an attempt to get *above* these interfering wavemeters but do not seem to meet with much success. Many

of our old-timers, of five or six week's experience, have written to the newspapers asking if those pests could not be dealt with by law, but they are told that as the offenders do this dot-and-dash noise on 200 wavemeters at a time, nothing can be done about it but to pass a new law compelling them to desist during broadcasting hours, i.e., midnight to noon, and noon to midnight. I understand your magazine, which depends so much on this new art, has considerable influence with these fellows and I request you to ask them to cease until they have learned something about this new art from reading the radio page of their daily paper.

Hopefully yours,

R. N. Keever.

4602 Harding Ave., Detroit, Mich.

## "Kiss Me By Wireless"

Gary, Ind.

Editor, QST:

Not long since I attended a public radio "concert". There are times in a man's life when a whole flock of Wouff Hongs would only scratch the surface. This was one of them.

When the OW and I entered the hall we found a goodly crowd of pop-eyed citizens listening to the emanations from a decrepit magnavox, backed up to a regenerative set apparently expecting a spill any moment. Three or four steps of "audio" were doing their utmost to make a bad matter worse.

The genius at KYW was grinding out his usual line when suddenly his voice rose to a terrific shout as the regenerator took the long looked for spill. A bunch of razor-back hogs in a field of paw-paws would be a faint whisper to the raucous uproar that followed. There was a wild leap from the front row as the operator (?) got on the job, and as we expected, got the set right back on the precarious "peak" it had been on before.

The program ground on. A duet was announced. After a considerable pause two girls began singing but without accompaniment. They struggled on though it was evident under suppressed emotions. Finally the pianist arrived and in an endeavor to find the place and the key at the same time, swept unto himself a whole



armful of grace notes and sprayed them recklessly on our beloved ether. The effect was immense.

After a review of the news and sporting events (which we have already scanned in the evening paper) the Daily News musical program began and gave promise of being unusually good but our expectations were short lived. There was a slight commotion down in front and the operator approached the instruments. With blood-thirsty carelessness he strangled the soprano right in the middle of a high C (no pun intended.)

The speaker of the evening was now introduced, being as advertised, a "radio engineer of twelve years experience." After a few introductory remarks he got right down to business and explained the whys and wherefores of radio in a manner all his own. It was unique. The OW gritted her teeth and grinned. Gradually there spread over me the realization that all the time I had spent in studying radio had been wasted. Here was the fountain head of wisdom—all the rest were wrong. Just before I passed out, I heard this startling information, "—and after the electricity in the transmitting aerial gets up to a frequency of over ten thousand per second it no longer stays on the wires but *jumps off* into space and travels through the *air* till it gets to the receiving aerial".

I did not intend to razz KYW when I started out for he is a good station and does not try to overmodulate. Furthermore he has not as yet broadcasted any lectures on peeling potatoes and we can forgive him everything else.

But this other thing—these lectures by "radio engineers" on how radio *doesn't* work—these raucous concerts to the awed neophytes—can't we organize a Society for the Prevention of Cruelty to Dumbells or something?

Sincerely yours,

E. F. DeBra.

### Antenna Resistance Can't Be Calculated

Editor, QST—

Despite the vigorous objections of myself and Mr. J. C. Warner to some of "Prof. Bugs" false antenna calculations we still have with us a large group that is firmly convinced of its ability to *calculate* antenna resistance without any measurements except the antenna dimensions. This is impossible. Let us go over the argument again.

"Antenna resistance" means "total antenna resistance" which is made up of:—

- (a)—Wire resistance
- (b)—Ground resistance
- (c)—Dielectric resistance
- (d)—Radiation resistance.

Now let's see how nearly possible it is to calculate these things.

**Wire Resistance**—Even if we know the resistance of a foot of the antenna wire at the working wave we cannot calculate wire resistance of the finished antenna since we know almost nothing about the distribution of current in the antenna. And a change in current distribution has a most emphatic effect on the resistance of a conducting system. So this will have to be given up or guessed at.

**Ground Resistance**—There will not be much argument about the statement that ground resistance cannot be calculated.

**Dielectric Resistance**—The dielectric resistance is that due to the nearby houses, trees, towers, insulators and masts. The mere statement of the causes of the resistance shows the impossibility of calculating it. And the value varies so widely that one cannot guess at it.

**Radiation Resistance**—Radiation resistance was defined by a humorist as "That resistance which, if there was such a thing as radiation resistance, would be absorbing the antenna power that isn't being absorbed but is getting away."

That is about as good as most of our information about radiation resistance.

Years ago Fleming gave us, (for our sins) a formula for calculating radiation resistance. It was correct for an antenna with a very large flat top supported over salt water by imaginary towers.

Even the word "efficiency" has not been mis-used as has that formula.

$$R_{rad} = \frac{1600 h^2}{\lambda^2}$$

To begin with, the formula is for antennas with very large flat tops. There is no such thing in amateur work. It is for an antenna over salt water; most of our antennas are over anything from wet loam to granite. It takes no account of these things.

But if you insist on using the formula suppose you put in the proper value for "h—the effective height." You can't do it because you have no idea what the effective height of your antenna is. What for instance is the effective height of a 60 by 60 foot T with a two story brick house under one end, 27 telegraph wires on 30 foot poles running by at 60 degrees to the antenna, two 10x8 tin garages next the lead-in and a steel-frame office building 20 feet from the other end of the antenna?

Perhaps *your* antenna is out in open country but even you have some metal poles and guy wires that the formula does not refer to.

In any case the effective height is not the distance from the antenna top to ground, from the antenna top to counterpoise or anything of that sort which can be measured with a ruler or a tape-line. The distance is always less.

The general result is that one had better

guess at the radiation resistance—it is just as accurate as the calculation and is more honest, all hands being at once aware that the result is nonsensical.

*Summarizing:—*

- (a)—Wire—calculation of resistance doubtful
- (b)—Ground—calculation of resistance impossible
- (c)—Dielectrics—calculation of resistance impossible
- (d)—Radiation—calculation of resistance exceedingly unsatisfactory for amateur antennas.

The only way to find out anything about an antenna is to measure its constants. When a resistance curve has been secured it can be broken up into other curves showing the

- (a)—Radiation resistance
- (c and d)—Ground and wire resistance
- (b)—Dielectric resistance.

There is now being prepared a paper showing how this method was used at several stations to locate and cure antenna losses.

Of course some judgment must be used even in making measurements. Antenna measurements are difficult to make accurately and the results are usually nothing to brag of. But that does not excuse doing deliberately foolish things. Recently I ran across one of our outfits with a book on the key of his 100 watt Hartley-circuit transmitter and a resistance box in the antenna lead. His idea was to cut in resistance till the antenna current had dropped one half, then call the series resistance equal to the antenna resistance.

The "Old Man's" vocabulary may include comment suited to such alleged "measurements". Till the Old Man speaks it is possible to form an opinion by securing the excellent Bureau of Standards "Circular 74"\* and learning how to do the thing right.

This has the added advantage that one is all ready for the next man that comes along with a claim of a 4 ohm 200 meter antenna, and is able to prove that he forgot 7 ohms of ground resistance, 5 of dielectric resistance and miscalculated the 4 ohms of radiation resistance.

Yours truly,  
S. Kruse.

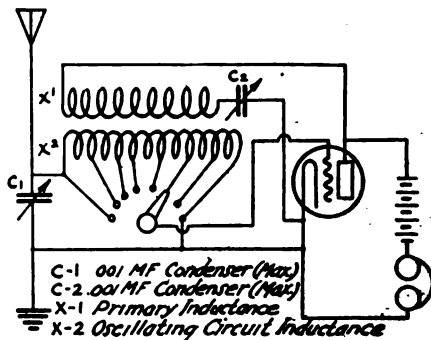
## A Simple Long-Wave Circuit

New York.

Editor, QST—

The enclosed diagram is of a new departure in long wave regenerative circuits which is particularly suitable for amateur use. Should any of your readers use it I should be very much pleased to hear from them as to the range and signals received

with it. It comprises the old Weagant Circuit generally known as the X circuit but it also has the advantage of variable inductance between coils and several other convenient features which tend to flexibility.



The inductances X-1 and X-2 are honeycomb or other like coils of which X-1 must be especially wound to provide for the variable tap switch. The taps should be taken off at close intervals, i.e., not more than 100 turns apart and closer if possible. X-1 and X-2 are placed in the circuit in a variable coupled relation using a DeForest two-coil mounting. The same circuit can be used with a loose coupler or with specially wound coils to suit the maker but the writer has obtained more satisfactory results with honeycomb coils.

The absence of a grid condenser or leak is a noticable feature, but because of the direct coupling it has been found that their use is not only unnecessary but that they materially detract from the efficiency of the apparatus.

By using coils of different values, a range of from 2500 to 20,000 meters can be obtained. The coils X-1 and X-2, however, must be of nearly the same inductance, a different antenna, of course, requiring different primary coil.

The writer, with this set and a two step audio-frequency amplifier, copied POZ in daytime 80 feet from the phones. By opening the windows of the writer's station and alternately tuning in one of the U.S. arc stations and transmitting with a ¼ KW open rotary gap it was found that the arc station could be read at a greater distance from the phones than the open gap.

For an inexpensive and simply operated long wave CW receiver it is unbeatable.

Yours truly,  
2APS.

## Flowery!

Dear Eddy:

The next time I hear of a new discovery in this 'ere wireless game, I intend to stuff my ears with cotton. Things are getting worse every day. Recently I read of an in-

\*Obtained from the Gov't Printing Office, Washington, D. C., for 60c, stamps not accepted.

vention which would send perfume by wireless and I nearly choked trying to swallow that. Well OM I no sooner got over that than I heard of another "Bird" who discovered that plants receive and respond to wireless waves.

Now if that guys statements are true we may expect the following very soon—

By way of the dahlia

Comes news from Australia

"Many Bitten by the Wireless Flee"

While the sensitive aster

Relates that disaster

Has befallen a liner at sea.

In far Patagonia—

So says the begonia—

They're taking up study of stars

But the plant to attract us

Will be the first cactus

That picks up a message from MARS.

The term "Wireless Plant" has been used a long time and I think in view of the discovery that certain flora are sensitive to wireless waves in telegraphy and telephony, enterprising seed specialists will add a section similar to the following in their catalogues.

#### ELECTRON, ION & COMPANY

Specialists in tested seeds for Wireless Plants. Claiming French Beans—These beans attain a height of six feet and are very useful as aerials. TRY OUR SPECIAL 5, 6, or 7 "spud" AMPLIFIERS. Our Onion sets are neat and the best of bulbs used. As it is only recently that onion growing from sets has become popular, it may be well to explain that the "set" is a small, specially ripened bulb and may therefore be called a single bulb transmitter. These sets though small, have an exceptional range owing to their good radiation. They should not be used in the vicinity of a visual receiver as a bad damping effect will be experienced in the eyes.

#### DETECTORS

*Chrysanthemum Sagetum Grandiflorum*—Supersensitive. Replaces carborundum and needs no potentiometer. Being a hardy annual it only needs to be set in the best ground earth.

*Cyclamen Persicum*—Can be used as a substitute for Zincite-Bornite or Silicon-Carbon.

*Galega Officinalis*—Substitute for Galena. A good detector for amateurs.

*Minosa pudica* (better known as the sensitive plant)—A very popular plant which has earned its name by its sensitivity.

#### MISCELLANEOUS

India—rubber plant—A stock of these should be kept on hand for insulating purposes.

*Convolvulus*—This plant is useful for winding inductances.

Sweet Peas, Afterglow—Violet and electric blue, quite distinct.

Glow Worm—Lovely shade of salmon pink. Both useful as radiation meters.

Beet—Unsurpassed for the reception of continuous waves.

Leeks, Various—For use with grid condensers.

*Capsicum Shili*—For heating valve filaments.

Spring onions—For suspending detectors. Very good shock absorber.

Iris, generally known as "Flags"—These plants can be trained to receive and translate wireless signals into semaphore.

*Eschscholtzia*, *Lynchnis arkwrightii*, *calceolaria veitchii*, *Haborothamnus elegans*, *xeranthemum*. A few of these plants should be kept on hand for code practice.

*Viscaria Oculata Azurea*—The last word in wireless sets. Useful at seances owing to its ability to receive from other worlds.

*Funkia Sieboldi*—Only a few of these transmitters left. They make good souvenirs, having been captured from Huns in the late war.

Now that I have got this bunk off my chest I feel relieved. I must quit now that I feel sick.

Hoping you are the same, I am  
1 COW.

#### Clearing Induction

Editor, QST:

I note in the current issue of our QST, that in the letters from 'the gang' you request some dope on the elimination of arc light induction, in connection with one of our brothers' inquiries. Perhaps an experience of the writer will not be amiss.

Shortly after purchasing a home in a western city, a few years ago, the power company saw fit to run 66,000 volt lines up our street, and which passed within twenty feet of my T antenna. Naturally, I knew every leaky insulator on the line, personally, in less than two weeks. I experimented with all known forms of induction eliminators, so-called, with no success, and then started on the antenna proposition. Swinging it at right angles, of course decreased the racket slightly, but not enough. I then thought, "—if at a right angle, why not a double angle" and decided for a fan antenna. I accordingly erected an eight wire fan, spread thirty feet at the top, sixty feet high, bunched at the lead-in insulator, and, while it positively did not cut out induction, it did eliminate it to the extent whereby I could hear California radiofones in the state of Washington. A steady droning buzz, but intense, was always apparent, but did not hinder ordinary reception. Perhaps this will help our friend.

Cordially,

Howard S. Pyle,

Howard S. Pyle, Ex NVH, NPC, etc.

Chief Engineer,

The Precision Equipment Co.

## Induction QRM

Darby Pa.

Dear Disheartened Ham:

I am burning the midnight oil to write a letter of sympathy to you. I too have had the experience of which you write in such a disheartened manner. For about a year, in fact up until April 1st of this year, I lived in a location that would give one the "willies" if looked at from a standpoint of possible sources of QRM. I lived at 59th and Market Streets, in an apartment, and had an aerial that ran parallel to the elevated line and the arc lamps of which you speak. If you will visit the neighborhood you will find that there are three theatres, one printing plant two or three air compressor outfits, several electric pianos, and a number of other possible sources of QRM. Like you, I suspected the arc lamps and the elevated railroad, but take it from me, old man, there is nothing to it, as there is no QRM from the elevated except when a car with a poor contact shoe passes your door. Likewise the theatres and sign flashers, and the same holds good with regard to the electric pianos. But—look out for a mercury arc rectifier.

This particular outfit was the source of all my QRM, and it was with a sigh of relief I noted the removal of the outfit and the substitution of a Tungar. Now my suggestion to you is to look around for something of this particular type, or a motor with a grounded frame and sparking brushes. I would be delighted to have your name and address and will co-operate with you to the extent of my ability.

Very truly yours,  
E. R. McCaskey,  
1025 Main Street.

## Pom Sat?

Dear Ed:

In writing just a line to let you know I'm feeling fine except for some few thousand things that make my old heart ache, by jings. They sure do take one's heart away when they keep coming day by day until they drive one nearly wild. Just lend your ear to this small child, and listen to my tale of woe.

It wasn't many years ago that wireless struck my noble dome, so little Willie hurried home and, from some odds and ends around, constructed aerial set, and ground, and eagerly strained each small ear to try and see if he could hear the Navy Yard, eight miles away, and oh how sweet that lovely day when first I heard it in my phones, a-buzzing like a swarm of drones.

Ah! Well I recollect those times and how I saved up all my dimes to buy some parts for a new set (I have them in my closet yet). Some, thrown together in great haste; and others, done to the queen's taste. From simple loaders, wound by hand, I sprung

to sliding tuners grand. On, on I went through all the kinds of tuners, large and small, one finds belonging to a Radio ham. Say, brother, don't it beat the band what fools we are to sweat and sweat to hear the things we haven't yet.

Maes Ouil! My eagerness led me on from Grebe set's to Paragon, and then to me a radio friend (?) a treatise on Round's ground did send, and so I pulled up my nice ground and built one that was nearly round in order that my sending station would have a greater radiation. Oh yes! I had the Radio Rage. From flat top aerials to cage I changed, and then, with all the boys, to keep in style a counterpoise I swung beneath my aerial grand, and then I cussed to beat the band because my dear Round ground so far could not be ten feet in the air. But these were nothing. Ah no no, these pleasures all must undergo.

Ambition drove me on and on, and so upon one lovely morn when looking through my QST I saw the set of 1QP. To make the story sweet and short, I hurried to the store and bought the things that one would have to get if he were going to build this set.

Yea Bo' I had it working swell and so I thought I might as well instruct the family in the art of tuning in some distant part. Ah! Woe to me! and Sacre Bleu! Wretched rascal! Dog! Cur! Why did you yield to that temptation? Why let them enter your sweet station? For now it isn't yours doggonit, the folks have got an option on it!

It was all mine a month before. Its mysteries are mine no more, and every time I wish to strain any ear drums for a six, in vain do I tell mother that I think there is a bad leak in her sink; or father that the barn's on fire. What e'er I say, I am a liar. Ner' heaven nor earth (nor I as yet) can get them to leave my—their set. And so it goes.

Day in, day out, these worries drive me near to rout. The housework and the cooking hot have fallen to my miserable lot, while my beloved parents dear, upstairs are straining every ear at every hour of the day for WJZ or KDKA.

Well—now I think I am all through, and so I bid you sad adieu. I wish you years of luck and joy.

Sincerely,  
A New England Boy.

## Colyum Conductors Wanted

Kokomo, Ind.

Editor, QST:

Permit a suggestion or two re the editorial "Wild, Wild Waves" in March QST, where the statement is made that many newspaper radio departments are edited by "experts," many of whom simply 'ain't"

For evidence of the truth of this statement, one need only glance at one or two of the departments referred to in large Sunday papers, though of course there are a number of them which are capably edited.

Here, it would seem, is a splendid chance for our A.R.R.L. gang to lend a helping hand to the struggling novice and at the same time render our League an invaluable service—why not A.R.R.L. men to man the radio departments? Surely any one of them is wise enough on radio matters to answer the technical questions of the average beginner, (barring of course, such ridiculous queries as,) “Where can I buy 160 meters to add to my 200-meter set so I can hear concerts?”

In papers where no radio department appears, it should be an easy matter to arrange with the editor for a weekly or daily column when the widespread radio fad at present makes the subject of interest to so many people.

While we ourselves can lay no claim to being “experts,” in propelling such a section in a local paper for the last several months we have found the task no mean one. To interest the majority of readers, programs of the larger broadcasting whose concerts are received locally are published each day. These nearly all of the radio phone stations will gladly furnish to radio editors on request, for the publicity they derive from it.

Here lies the opportunity for boosting the A.R.R.L. By printing all the varied activities, achievements of and information about the A.R.R.L. and its good work, we interest the novice reader in the League, with the result that he soon stands to become a full-fledged ham. A “questions and answers for readers” section is not amiss here and this further interests the reader in radio.

Although some work is involved in gathering such matter and preparing it for the press, the results are well worth the effort. As to a source of news for this purpose, much valuable material can be found in our own QST. Other magazines and publications also offer additional notes, but care should be taken to prevent the appearance of “yellow” and sensational stories which are unfounded on fact.

I do not claim to be the originator of this idea, for many papers were running such columns before it ever occurred to me, including F. F. Hamilton's “Radio Waves” in the Indianapolis News, but I believe that the opportunity for boosting the A.R.R.L. is present here and would like to see it carried out.

With best 78's,  
W. F. Lanterman, 9AVO.  
A.R.R.L. City Manager.

## HOWARD F. MASON

(Concluded from page 63)

an average of 100 messages per month and sometimes as high as 225. He is a crack operator and chirps off traffic at a rate away above the average on the east coast.

Mr. Mason has been prominent in organizing the Totem Radio Club of which he has been president for the past year. He is also secretary of the Seattle Radio Association, secretary of the Seattle Section of the Institute of Radio Engineers, and Northwestern Division Manager of our A.R.R.L. As Division Manager he is very able and rates high admiration from his men. Tho unassuming in manner he “uses his bean” and has the respect and confidence of all his associates.

## M. F. HARROD

(Concluded from page 49)

one of the first daylight C.W. routes—thru 8ZG, 8AGZ, 8VS and 8IB. In spite of all this he graduated from High School as president of his class and with honors.

Just about a year ago he took 8VS to the sunny south and set about to show that radio in Florida was not impossible. 4II started up for good at Orlando last December and has been doing fine work ever since. Mr. Harrod was appointed A.R.R.L. District Superintendent for Florida and the men all over the state have been more than glad to co-operate with him in putting the state on the radio map. Last February the A.R.R.L. men got together and sent 4II to the big convention in Washington where he learned many new ideas of great help in the organization thruout the state. From the day he started until the present time he has literally *lived* radio and he still expects to always do so.

## THE NEW RADIO BILL

(Continued from page 56)

or in any manner, either voluntarily or involuntarily, disposed of to any other person, company, or corporation without the consent in writing of the Secretary of Commerce.

“C. That the Secretary of Commerce, subject to the limitations of this Act, in his discretion, may grant to any applicant therefor a station license provided for in sections 1 and 2 hereof, except that he may grant such license only to a station which is in the interest of the general public service.

“No license granted by the Secretary shall be for a longer term than 10 years, and any license granted may be revoked as hereinafter provided. Upon the expiration of any license the Secretary, in his discretion upon application therefor, may grant a renewal of such license for the same or for a lesser period of time.

“The Secretary of Commerce is hereby authorized to refuse a license to any person, company, or corporation, or any subsidiary thereof which, in the judgment of the Secretary, is monopolizing or

seeking to monopolize radio communication, directly or indirectly, through the control or the manufacture or sale of radio apparatus or by any other means. The granting of a license shall not estop the United States from prosecuting such person, company, or corporation for a violation of the law against monopolies or restraint of trade.

"D. That the Secretary of Commerce may grant licenses only upon written application therefor addressed to him, which application shall set forth such facts as he by regulation may prescribe as to the citizenship, character, and financial, technical, and other ability of the applicant to operate the station; the ownership and location of the proposed station and of the stations with which it is proposed to communicate; the wave lengths and the power desired to be used; the hours of the day or other periods of time during which it is proposed to operate the station; the purposes for which the station is to be used, and such other information as he may require. Such application shall be signed by the applicant under oath or affirmation.

"E. That such station license as the Secretary of Commerce may grant shall be in such general form as he may prescribe, but each license shall contain in addition to other provisions a statement of the following conditions to which such license shall be subject: (a) The ownership or management of the station or apparatus therein shall not be transferred in violation of this Act. There shall be no vested property right in the license issued for such station or in the bands of wave length authorized to be used therein, and neither the license nor any right granted thereunder shall be assigned or otherwise transferred in violation of this Act; (b) such licenses shall contain such other conditions, not inconsistent with this Act, as the Secretary of Commerce may prescribe.

"F. That any station license granted by the Secretary of Commerce shall be revocable by him for failure to operate service substantially as proposed in the application and as set forth in the license, for violation of or failure to observe any of the restrictions and conditions of this Act or of any regulation of the Secretary of Commerce authorized by this Act or by the provisions of any international radio convention ratified or adhered to by the United States or any regulations thereunder, or whenever the Secretary of Commerce shall deem such revocation to be in the public interest: Provided, That no order of revocation shall take effect until thirty days' notice in writing thereof to the parties known by the Secretary to be interested in such license. Any person in interest, aggrieved by said order, may make written application to the Secretary at any time within said thirty days for a hearing upon such order and upon the filing of such written application said order of revocation shall stand suspended until the conclusion of the hearing herein directed. Notice in writing of said hearing shall be given by the Secretary to all the parties known to him to be interested in such license twenty days prior to the time of said hearing. Said hearing shall be conducted under such rules and in such manner as the Secretary may prescribe. Upon the conclusion thereof the Secretary may affirm, modify, or revoke said orders of revocation.

"SEC. 3. A. That the actual operation of apparatus in any radio station for which a station license is required by this Act shall be carried on only by a person holding an operator's license issued thereunder. No person shall operate any apparatus in such station except under and in accordance with an operator's license issued to him by the Secretary of Commerce.

"B. That the Secretary of Commerce, in his discretion, may grant special temporary operators' licenses to operators of radio apparatus under such regulations, in such form, and upon such conditions as he may prescribe whenever an emergency arises requiring prompt employment of such an operator.

"C. That an operator's license shall be issued by the Secretary of Commerce in response to a written application therefor, addressed to him, which shall set forth (a) the name, age, and address of the applicant; (b) the date and place of birth; (c) the country of which he is a citizen;

and if a naturalized citizen of the United States, the date and place of naturalization; (d) the previous experience of the applicant in operating radio apparatus; and (e) such other facts or information as may be required by the Secretary of Commerce. Every application shall be signed by the applicant under oath or affirmation.

"D. That an operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is proficient in the use and operation of radio apparatus and in the transmission and reception of radiograms by telegraphy and telephony. Except in an emergency found by the Secretary of Commerce to exist, an operator's license shall not be granted to any alien, nor shall such a license be granted to a representative of a foreign government.

"E. That an operator's license shall be in such form as the Secretary of Commerce shall prescribe, and may be suspended by him for a period not exceeding two years upon proof sufficient to satisfy him that the licensee: (a) has violated any provision of any act or treaty which the Secretary of Commerce is authorized by this Act to administer, or of any regulation made by the Secretary under any such act or treaty; or (b) has failed to compel compliance therewith by any unlicensed person under his supervision; or (c) has failed to carry out the lawful orders of the master of the vessel on which he is employed; or (d) has wilfully damaged or permitted apparatus to be damaged; or (e) has transmitted superfluous signals, or signals containing profane or obscene words or language.

"F. That a license may be revoked by the Secretary of Commerce upon proof sufficient to satisfy him that the licensee was at the date his license was granted to him, or is at the time of revocation, ineligible for a license.

"SEC. 4. A. That after the approval of this Act the construction of a station for which a license is required by this Act shall not be begun, nor shall the construction of a station already begun be continued, until after a permit for its construction has been granted by the Secretary of Commerce upon written application therefor. This application shall set forth such facts as the Secretary of Commerce by regulation may prescribe as to the citizenship, character, and the financial, technical, and other ability of the applicant to construct and operate the station, the ownership and location of the proposed station and of the station or stations with which it is proposed to communicate, the wave length or wave lengths desired to be used the hours of the day or other periods of time during which it is proposed to operate the station, the purpose for which the station is to be used, the type of transmitting apparatus to be used, the power to be used, the date upon which the station is expected to be completed and in operation and such other information as the Secretary of Commerce may require. Such application shall be signed by the applicant under oath or affirmation.

"B. That such permit for construction shall show specifically the earliest and latest dates between which the actual operation of such station is expected to begin and shall provide that said permit will be automatically forfeited if the station is not ready for operation within the time specified. The rights granted under any such permit shall not be assigned or otherwise transferred to any other person, persons, company, or corporation, without the approval of the Secretary of Commerce: Provided, That a permit for construction shall not be required for Government stations to be used exclusively for communication of official business or for private stations as provided for in section 4, fifteenth regulation, of the Act of August 13, 1912. The granting of this permit to construct a station as herein required shall not be construed to impose any duty or obligation upon the Secretary to issue a license for the operation of such station.

"SEC. 5. That an advisory committee is hereby established to whom the Secretary of Commerce shall refer for examination and report such matters as he may deem proper relating to: (a) the administration or changes in the laws, regulations, and treaties of the United States relating to radio

communication; (b) the study of the scientific problems involved in radio communication with the view of furthering its development; (c) the scientific progress in radio communication and use of radio communication.

"The advisory committee shall consist of twelve members, of whom one shall be designated by the Secretary of State, one by the Secretary of War, one by the Secretary of the Navy, one by the Secretary of Agriculture, one by the Postmaster General, and one by the Secretary of Commerce, to represent these departments, respectively, and six members of recognized attainment in radio communication not otherwise employed in the Government service to be designated by the Secretary of Commerce.

"The necessary expenses of the members of the committee in going to, returning from, and while attending meetings of the committee, including clerical expenses and supplies, together with a per diem of \$25 to each of the six members not otherwise employed in the Government service for attendance at the meetings, shall be paid from the appropriation made to the Department of Commerce for this purpose.

"SEC. 6. That radio telephone stations, the signals of which can interfere with ship communication, are required to keep a licensed radio operator, of a class to be determined by the Secretary of Commerce, listening in on the wave length designated for distress signals during the entire period the transmitter of such station is in operation.

"SEC. 7. That regulation first of section 4 of said Act of Congress approved August 13, 1912, is amended by striking out the words 'this wave length shall not exceed six hundred meters or it shall exceed one thousand six hundred meters.'

"Regulation second of section 4 of said Act of Congress approved August 13, 1912, is amended by striking out the words 'provided that they do not exceed six hundred meters or that they do exceed one thousand six hundred meters.'

"Regulations third and fourth of section 4 of said Act of Congress approved August 13, 1912, are hereby repealed.

"Regulations fifteenth and sixteenth of section 4 of said Act of Congress approved August 13, 1912, are amended by striking out the words 'exceeding two hundred meters' and substituting in lieu thereof the words 'of not less than one hundred and fifty meters nor more than two hundred and seventy-five meters.'

"SEC. 8. That any person, company, or corporation who shall erect, use, or operate any apparatus for radio communication in violation of this Act, or knowingly aid or abet another person, company, or corporation in so doing, or knowingly make any false oath or affirmation for the purpose of securing a permit or a license, shall incur a penalty not to exceed \$1,000, which may be mitigated or remitted by the Secretary of Commerce, and the permit or license of any person, company, or corporation who shall violate any of the provisions of this Act, or of any of the regulations of the Secretary of Commerce issued hereunder, or knowingly make any false oath or affirmation for the purpose of securing a permit or license, may be suspended or revoked by the Secretary of Commerce.

"SEC. 9. That the Secretary of Commerce is hereby authorized and directed to charge, and through the imposition of stamp taxes on applications, licenses, or other documents, or in other appropriate manner, to collect the fees specified in the schedule following. The Secretary shall collect said fees through the collectors of customs or other officers designated by him, and he may make such regulations as may be necessary to carry out the provisions of this section.

#### "SCHEDULE OF FEES TO BE COLLECTED

"For transoceanic radio station license, \$300 per annum; for commercial land station license, other than transoceanic, one kilowatt transmitter input or less, \$50 per annum; and for each additional kilowatt or fraction thereof, \$5 per annum; for ship station license, \$25 per annum; for experiment station license, \$25 per annum; for technical and training school license, \$15 per annum; for special amateur station license, \$10 per annum;

for general and restricted amateur station license, \$2.50 per annum; for commercial extra first-class operator's license, \$2.50 per annum; for commercial first-class operator's license, \$1.50 per annum; for commercial second-class operator's license, \$1 per annum; for commercial cargo grade operator's license, 50 cents per annum; for experiment and instruction grade operator's license, \$1 per annum; for amateur first-grade operator's license, 50 cents per annum; for amateur second-grade operator's license, 50 cents per annum; for commercial extra first-class radio operator's examination for license, \$2.50 for each examination; for commercial first class radio operator's examination for license, \$2 for each examination; for commercial second-class radio operator's examination for license, \$1.50 for each examination; for commercial cargo grade radio operator's examination for license, \$1 for each examination; for experiment and instruction grade radio operator's examination for license, \$1 for each examination; for amateur first-grade radio operator's examination for license, \$1 for each examination; for amateur second-grade radio operator's examination for license, 50 cents for each examination.

"In the event that other classes of station and operators' licenses or other examinations shall hereafter be prescribed in any lawful manner, the Secretary of Commerce is hereby authorized and directed to charge and collect in the same manner as herein provided fees for such new classes of licenses and of examinations, which fees shall be substantially of the amount herein specified for the license and examination nearest in character and purpose to the new license or examination so prescribed.

"For failure to pay at the time and in the manner specified by the Secretary of Commerce any of the above fees the Secretary of Commerce is authorized to refuse to issue such licenses; or if issued, to suspend or revoke the same, as he may deem proper.

"SEC. 10. That wherever the words 'naval and military' stations appear in the Act to regulate radio communication, approved August 13, 1912, said words 'naval and military' shall be stricken out and the word 'Government' substituted in place thereof.

"SEC. 11. That all Acts or parts of Acts in conflict with this Act are hereby repealed."

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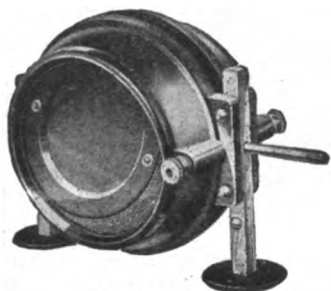
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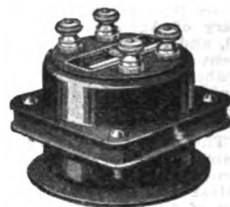
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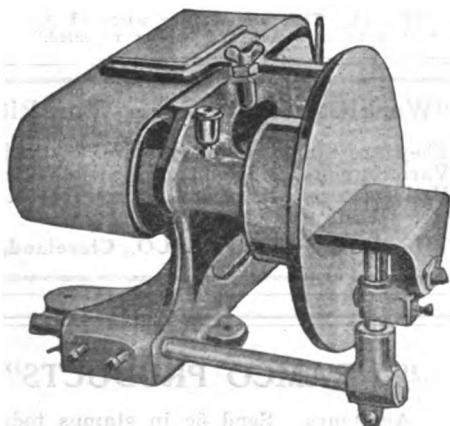
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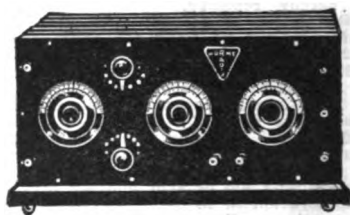
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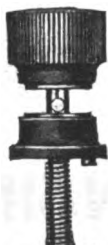
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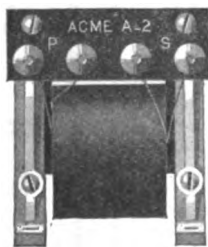
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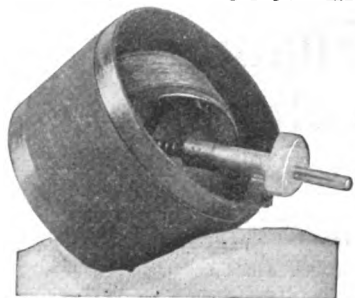
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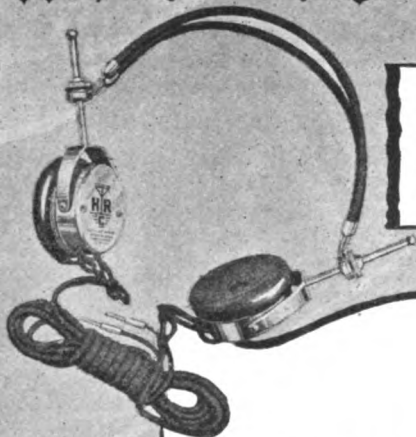
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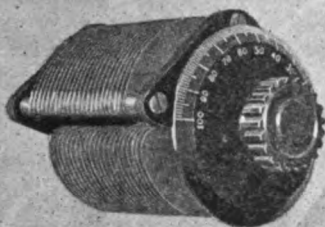
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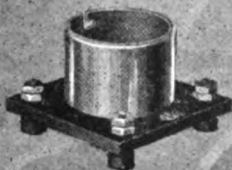
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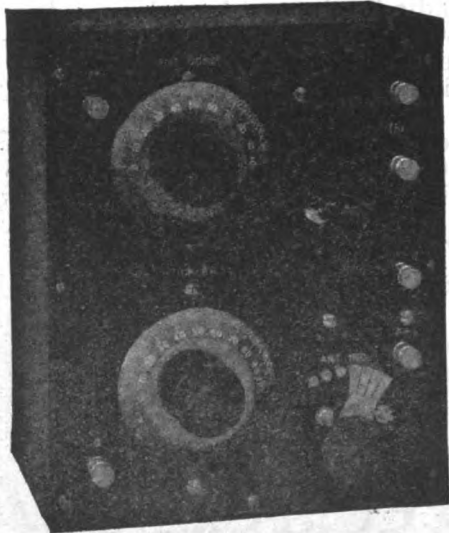
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Regenerates Wave Lengths of  
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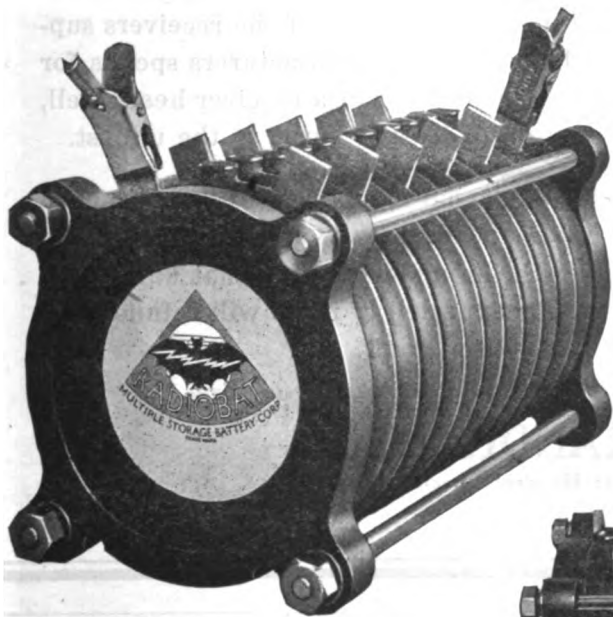


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# The Multiple Storage Battery Corporation Announces **RADIOBAT "B"**

*The Most Remarkable "B" Type Radio Battery.*

*Revolutionary in Design and Construction.*

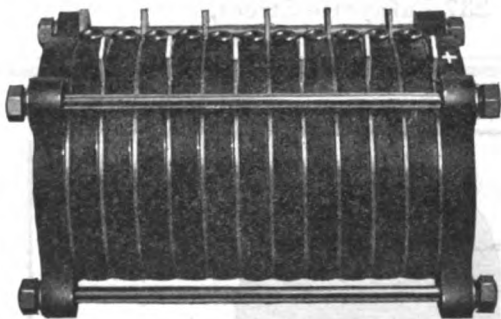


**R**ADIOBAT "B" is practically everlasting. It has no glass to break, no wooden case to rot, no separators of any kind.

Radiobat "B" is leak proof, it is free from acid fumes.

Any voltage desired can be obtained simply and easily.

Radiobat "B" will give a clearer tone to your Radio.



As Radiobat "B" has just been placed on the market, it is possible that your regular dealer will not be able to supply it. If this is the case, write us today enclosing \$12.00, the price of this extraordinary battery.

Also for Laboratories and Experimenters interested in high voltage with low amperage.

*Dealers write at once for our proposition.*



Established 1908

**350 MADISON AVENUE**

**NEW YORK**

# TO HEAR RADIO MUSIC PERFECTLY



The fact that Brandes *Matched-Tone* headsets are part of the standard equipment of the receivers supplied by the leading radio manufacturers speaks for itself. Unless the purchaser of a receiver hears well, he cannot enjoy broadcasted music to the utmost.

If your receiver is not equipped with a Brandes *Matched-Tone* headset you can buy one from your dealer, with the understanding that unless you obtain the results expected of it, he will refund your money after ten days' trial.

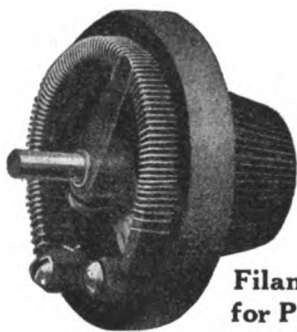
"Matched-Tone" is a trade-mark registered in the U. S. Patent Office.

## C. BRANDES, INC.

Wireless Headset Specialists

237 Lafayette Street,

New York, N. Y.



**No. 100  
Filament Rheostat  
for Panel Mounting**

### No Magnetic Material Used in Its Construction

Designed by Radio Engineers to insure quiet, smooth, step-by-step action and maximum sensitivity. Its current capacity is ample for the control of any receiving tube without overheating.

Both the base and the knob are made of genuine Thermoplas. All metal parts are nickel-plated.

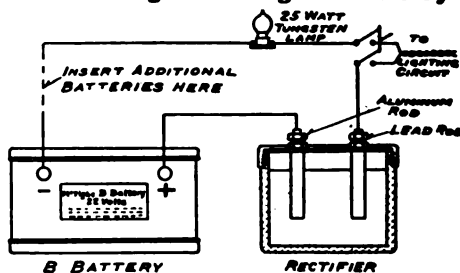
The overall diameter is only 2 1/4"—an important factor because of the limited space usually available.

Price (East of Rocky Mountains) \$1.00  
Get a C R L Rheostat from your Dealer or, if he cannot supply you we will send you one by mail postpaid for \$1.10.

**Central Radio Laboratories**

303 16th Street,  
MILWAUKEE, WISCONSIN

### The McTighe Storage B Battery



The McTighe Storage "B" Battery is of the alkaline type, is the most satisfactory source of plate potential, and can be charged from your lighting circuit for less than one cent. Can also be charged from farm lighting systems.

In ordinary service a one hour charge will last for several weeks.

The Battery is furnished in a 24 volt unit in an attractive case.

It is noiseless, and cannot be injured by accidental short circuit, overcharging or by standing idle.

Descriptive Leaflet on request

#### PRICES

|                     |        |
|---------------------|--------|
| Battery .....       | \$4.00 |
| Rectifier .....     | 1.50   |
| Rubber Filler ..... | .25    |

F. O. B. Irwin, Pa.

**ECONOMIC APPLIANCE COMPANY**

Successor to

McTIGHE BATTERY COMPANY  
Irwin, Pa.



## Stop Buzzing and Sizzling

**F**ORMICA insulation for Radio use is perfect insulation! It prevents buzzing, sizzling and noise that makes it hard to hear over your radio telephone.

There are no weak places in Formica panels. They are not affected by moisture and weather conditions and do not deteriorate. They will give perfect service for years.

Formica is the most widely used radio insulation. It is approved by the Navy and the Signal Corps. It is a thoroughly high quality product—the finest possible insulating material all the way through! It contains no absorbent matter that will take up water and lose its insulating strength through humidity and moisture.

Formica panels have a handsome gloss or satin finish—black and natural brown.

*DEALERS: We have now in operation an addition to our plant which doubles our previous capacity. Back orders for Formica are being shipped rapidly. We always do our utmost to serve you promptly.*

**THE FORMICA INSULATION COMPANY**  
**4620 Spring Grove Avenue, Cincinnati, Ohio**

### SALES OFFICES

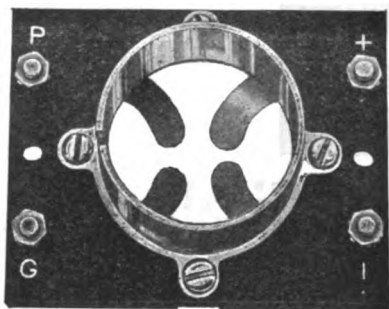
50 Church Street, New York, N. Y.  
9 South Clinton Street, Chicago, Ill.  
414 Finance Building, Cleveland, Ohio  
1042 Granite Building, Rochester, N. Y.  
415 Ohio Building, Toledo, Ohio.

422 First Avenue, Pittsburgh, Pa.  
Sheldon Building, San Francisco, Cal.  
932 Real Estate Trust Bldg., Philadelphia, Pa.  
321 Title Building, Baltimore, Md.

# FORMICA

Made from Anhydrous Redmanol Resins

## SHEETS TUBES RODS



### VACUUM TUBE SOCKET

Type SA Style No. 166

Attractive, rugged and perfect in all details. Phosphor bronze contact springs. Heat proof composition base. Price \$1.00.



### INDUCTANCE SWITCH

Type SC Style No. 167

The best switch at the best price, featuring a laminated phosphor bronze contact arm. Price \$0.50.

*Special Discounts to Dealers.*

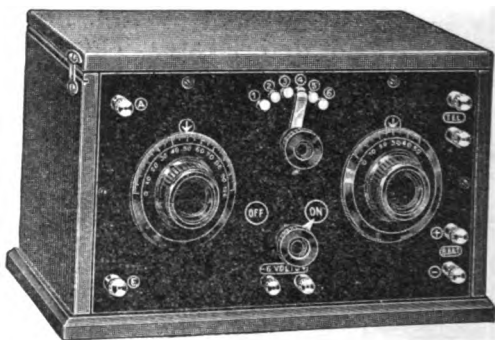
**THE RADIO ELECTRIC CO.**  
*Manufacturers and Jobbers in*  
**RADIO EQUIPMENT**  
 1427-29 LIBERTY AVENUE  
 PITTSBURGH, PA.

# TUSKA



Baseball  
Returns

# RADIO



Type 224—Price \$35

Tuska Regenerative Tuner (Licensed under Armstrong Patent No. 1,113,-149) Ready for Tube, Phones, and Battery. The ideal outfit for expert or beginner. Two knobs—one for wave length, the other for amplifying. Wave length range 150-650 meters. Type 224 has stood the test of public trial.

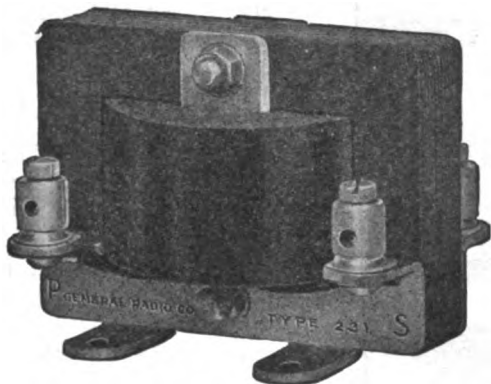
Dealers write your nearest jobber.

Send 5c for New Tuska Catalog No. 3

## The C. D. Tuska Company

1 Bartholomew Ave., Hartford, Conn.

# AMPLIFICATION



Amplification was first made practicable by the use of the three electrode tube. To take full advantage of the amplifying feature of the vacuum tube, the impedance of the grid circuit of the amplifier tube must be adapted to the impedance of the plate circuit of the detector, or preceding amplifier tube. This correct arrangement of impedance values can best be accomplished by a transformer. The primary and secondary windings, as well as the magnetic circuit can then be designed so as to give the maximum change of potential on the grid of the amplifier tube.

Amplification in this manner is only about a decade old. One of the first companies to design amplifying transformers was the General Radio Company. This Company has, furthermore, the distinction of being the first in this country to supply the experimenter with a closed core amplifying transformer.

Since the introduction of the first transformer, the subject of amplification has received much attention in our research laboratory and new improvements have been developed from time to time. Our Type 231-A amplifying transformer represents a six-year study of the problems of amplification. It embodies the best features in amplifier design.

There are several transformers on the market today having as high an amplification factor as the Type 231-A transformer. At certain resonant points, some are even higher. Extraordinary amplification at a single frequency is seldom to be desired. High amplification over a wide band of frequencies is the true measure of a satisfactory amplifying transformer. With the increase in radio telephony, this feature is not only to be desired but is essential. It is in this feature that the Type 231-A amplifying transformer excels. It is designed to give the maximum amplification possible without distortion when used with a Radiotron UV-201 vacuum tube.

The core construction is such that there is little tendency for the setting up of external fields with the resultant howling in the audio frequency circuit. The distributed capacity of the secondary is low so that the maximum potential is obtained on the grid of the tube.

The constants of the transformer are as follows:

|                                      | Primary     | Secondary    |
|--------------------------------------|-------------|--------------|
| Direct current resistance.....       | 1,100 ohms  | 5,500 ohms   |
| A. C. resistance @ 1,000 cycles..... | 11,000 ohms | 130,000 ohms |
| Reactance @ 1,000 cycles.....        | 66,000 ohms | 700,000 ohms |

**PRICE, COMPLETELY MOUNTED, \$5.00**

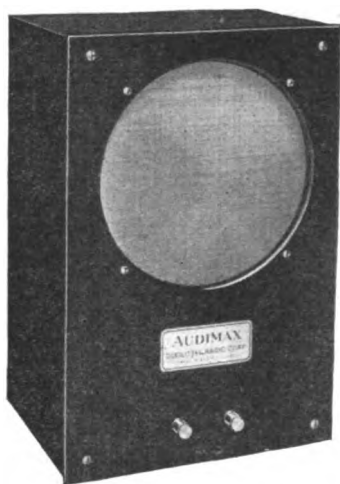
*Send for Free Radio Bulletin 911-Q*

**GENERAL RADIO CO.**

MASSACHUSETTS AVENUE AND WINDSOR STREET

Cambridge 39, Massachusetts

*Standardize on General Radio Equipment Throughout*



## THE AUDIMAX

The Audimax loud speaker is complete in every respect and will operate satisfactorily with any standard two or three stage audio amplifier.

The Amplifying horn used in the Audimax is so designed as to reduce distortion on voice and music. The Audimax enables you to hear concerts clearly and distinctly all over the house without using head receivers.

The cabinet is solid mahogany, beautifully finished with a genuine hand-rubbed finish. The dimensions are 16" by 11" by 9". Price \$30.00.

Ask your dealer to demonstrate the Audimax.

*Dealers and jobbers write for our immediate delivery proposition.*

**DOOLITTLE RADIO CORPORATION**  
817 CHAPEL ST., NEW HAVEN, CONN.

## NEW FREE BOOKLET

entitled

**Bradleystat**  
REGISTERED U. S. PAT. OFF.  
PERFECT FILAMENT CONTROL



Bradleystats  
for sale by  
Radio Dealers

**\$1.85**

P. P. 10c extra

Radio enthusiasts, everywhere, are sending for this up-to-the-minute booklet on the simplest and most accurate method of vacuum tube control. You should have a copy to keep up-to-date in radio. Does away with wire-wound, troublesome filament rheostats.

**Allen Bradley Co.**  
Electric Controlling Apparatus  
277 Greenfield Av.,  
Milwaukee, Wis.

*Manufacturers of graphite  
rheostats for 20 years.*

## Kwik-lite WIRELESS "B" BATTERIES Are Quality Batteries, Different From the Ordinary



They are made of Seamless Cells. Every one is carefully tested for noiseless operation before leaving the factory and is guaranteed to give longer life and better service than any other battery made. Send today for prices and full particulars about this BETTER Battery.

**THE USONA MANUFACTURING CO., Inc.**  
ONE HUDSON STREET  
New York City  
TOLEDO SAN FRANCISCO

# HOMMEL

## Radio Equipment Service For the Dealer

HOW much of an investment must I be prepared to make?

How much of this, that, and the other thing should I carry?

These are the most vital of the many questions which the prospective dealer must answer—

We can help you answer them, because we have a Dealer Service Department which is devoted to the study of markets, turn-over, the proper selection of radio equipment, and other subjects that concern the dealer.

Furthermore, we are distributors for more than 40 of the most prominent manufacturers, and are usually in position to supply most of the dealer's needs from our large stocks.

Write us about your problems—our service will not obligate you in any way.

Catalogue No. 100T sent upon request.

**WHOLESALE ONLY**

**LUDWIG HOMMEL & CO**  
530-534 FERNANDO ST.  PITTSBURGH, PENNA

### DISTRIBUTORS FOR

Radio Corp. of Amer.  
Westinghouse  
General Electric

|          |               |
|----------|---------------|
| Murdock  | Acme          |
| Fada     | Rhamstine     |
| Remler   | Kellogg       |
| Frost    | Holtzer-Cabot |
| Brandes  | Connecticut   |
| Pacent   | General Radio |
| Burgess  | Radio Service |
| Hipco    | Homcharger    |
| DeForest | Brach         |
| Baldwin  | Chelsea       |
| Signal   | Arkay         |

Clapp-Eastham  
and other leading  
manufacturers





# MAGNAVOX Radio



~ and even  
to this remote  
mountain hunting lodge

FAR from the  
"repair man"  
or your own  
workshop, you can  
always rely confi-  
dently upon the  
service of a Magna-  
vox Radio, the re-  
producer supreme.

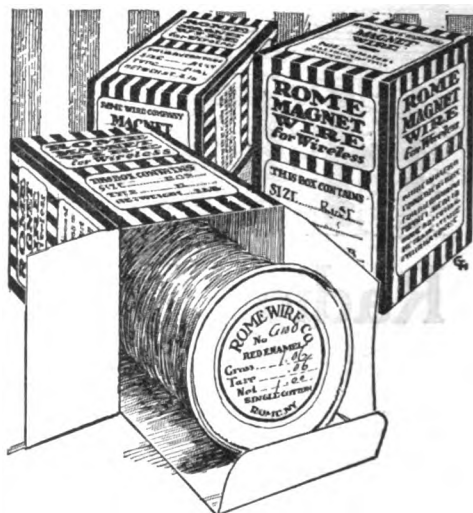
The name "Magna-  
vox" is a symbol and  
pledge of absolute satis-  
faction—the Magnavox  
Radio increases many  
times over the use you  
now get from your re-  
ceiving set.

Without Magnavox  
Radio no wireless re-  
ceiving set is complete.

Any radio dealer will  
demonstrate for you,  
or write to us for de-  
scriptive booklet and  
name of nearest  
dealer.

The Magnavox Co.  
Oakland, California  
N.Y. Office: 370 Seventh Ave.  
Penn. Terminal Bldg.

Radio brings it  
**MAGNAVOX**  
tells it



For satisfaction  
Demand Rome Blue  
and White Package  
or Label.

# ROME RADIO WIRE

## Magnet Wire

Best Quality Plain Enamel Covered;  
Enamel—and Single or Double Cot-  
ton Covered; Single or Double Cot-  
ton Covered.

All Sizes; 1/4-lb. to 40-lb. packages.

## Antenna Wire

Best Quality Solid or Stranded Cop-  
per Antenna Wire, plain or tinned;  
put up in lengths of 100-ft. and 150-  
ft. or on 24" reels of 200-lbs.

## At Your Dealer's

**ROME**  
**WIRE COMPANY**  
ROME, N.Y. . . . . BUFFALO, N.Y.

DISTRICT SALES OFFICES

NEW YORK . . . 50 Church Street . . . CHICAGO . . . 14 E. Jackson Blvd.  
DETROIT . . . 25 Parsons Street  
LOS ANGELES . . . J. G. Pomeroy, 336 Anna Street

2067-L

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



# Put Prest-O-Lite Quality Into Your Radio Equipment

What the name, *Prest-O-Lite*, means to the automobile, it means to radio. Embodying the same battery principles and the same standards, the Prest-O-Lite designed especially for radio use delivers regular Prest-O-Lite satisfaction.

For summer months, it is without a rival. Its continuous, even rate of discharge eliminates necessity of continual adjustment.

A tasteful piece of cabinet making in mahogany finish, it harmonizes with any furnishings. Equipped with rubber feet, it does not deface furniture.

The Prest-O-Lite is beyond question the foremost battery for radio use.

Ask for it at any Prest-O-Lite Service Station; or your electrical dealer will get it for you.

*We advise the selection of the battery of ample capacity to avoid frequent recharging. When it needs recharging, remember there is a Prest-O-Lite Service Station in your vicinity.*

## THE PREST-O-LITE COMPANY, Inc.

Carbide and Carbon Building  
30 East 42nd Street, New York

Eighth and Brannan Streets, San Francisco, Calif.  
In Canada: Prest-O-Lite Company of Canada, Ltd.,  
Toronto

→ **ATTENTION DEALERS!** *Prest-O-Lite Batteries for Radio Equipment make the quickest moving stock to-day. Write for our proposition.*

## *Prest-O-Lite* **BATTERY** *For Radio Use*



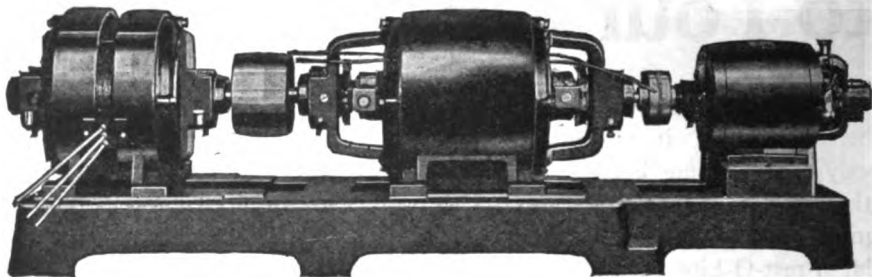
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TRADE

**ESCO**

MARK

## HIGH VOLTAGE MOTOR-GENERATORS STAND PRE-EMINENT IN WIRELESS FIELD



USED BY LEADING EDUCATIONAL INSTITUTIONS, U. S. GOV'T, RESEARCH LAB'YS,  
NEWSPAPERS, DEP'T STORES, ETC.

**ESCO**

Manufactures over 200 different combinations of windings for wireless and develops special apparatus  
for special requirements. Send us your problems

Write for Bulletin 237—Complete Information

**MOTORS—DYNAMOTORS—GENERATORS—MOTOR-GENERATORS**

SOLD BY PRINCIPAL DEALERS EVERYWHERE

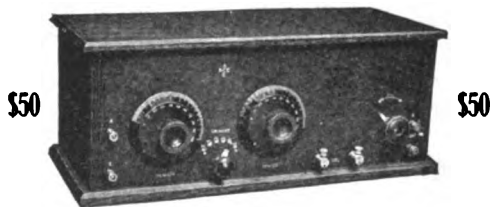


### ELECTRIC SPECIALTY CO.

215 SOUTH STREET

### STAMFORD, CONN., U.S.A.

If **QUALITY** counts, bear in mind that **ACE** equipment speaks for itself. An Ace type **TRU** Concert Receptor can be placed in your parlor, and is in a class with your piano or finest phonograph.



Licensed under Armstrong Patent No. 1,113,149

For electrical efficiency we claim our **TRU** to be equal or superior to any similar equipment now on the market.

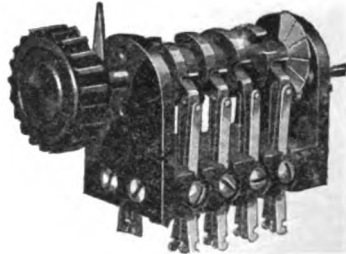
A very important point to be considered in purchasing a Concert Receiver is the proposed change of wave lengths of broadcasting stations. The majority of Radio receivers now on the market would be worthless should this change be effected. Our receiver is arranged for immediate adaption to this change by even a most inexperienced person.

Better investigate—we have literature for the asking.

**THE PRECISION EQUIPMENT CO.**  
2437-39 Gilbert Ave., Cincinnati, Ohio

**ARKAY**

## Universal Cam Switch For Amplifiers



The Arkay Switch takes the place of jacks and plugs in amplifier circuits. Instantly changes from detector to amplifier—to any stage. Can be used as a send-receive switch or short and long wave switch by merely shifting the position of the cams on the shaft. Highest materials and workmanship backed by Arkay guarantee.

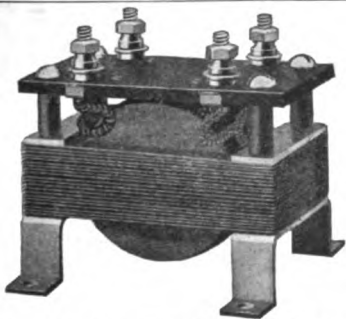
**Price \$5**

Directions With Each Switch  
Discounts to Manufacturers, Jobbers and Dealers

**Riley-Klotz Mfg. Co.**

17 Mulberry St.,

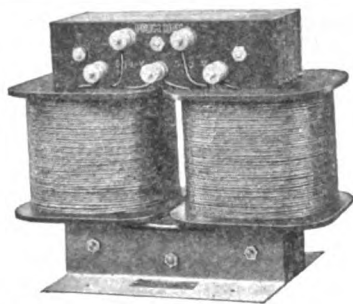
Newark, N. J.



No. 236-W Modulation Transformer

The NO. 236-W MODULATION TRANSFORMER, when used in connection with FEDERAL MICROPHONES, will properly modulate the voice frequencies and produce clear speech in Radiophone service.

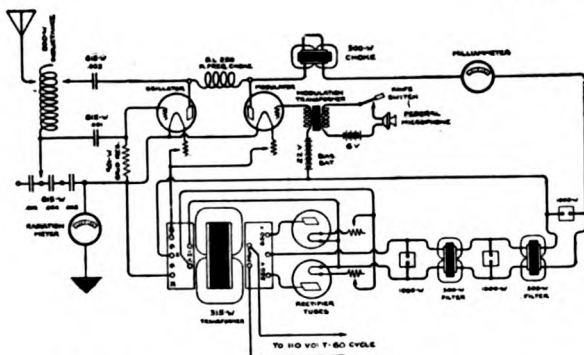
**FEDERAL**



No. 315-W 500 W. C.W. Transformer

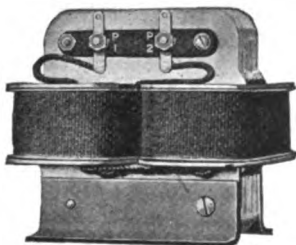
## C. W. APPARATUS

The NO. 315-W POWER COMBINATION TRANSFORMER, in connection with the circuit arrangement shown below, furnishes a 500 volt D.C. supply for plate potential and 12 volt supply for tube filaments, from your regular lighting circuit of 110 volts 60 cycle A.C.



CIRCUIT OF RADIOPHONE USING RECTIFIED A.C. POWER SUPPLY

The NO. 300-W FILTER COIL, used in connection with FEDERAL FILTER CONDENSERS, will smooth out the pulsations in the D.C. supply. It is also efficient as a Choke Coil to prevent the high frequency from getting into the power transformer or generator. The FEDERAL FILTER CONDENSER is especially designed for use in C.W. high voltage circuits and is guaranteed to withstand the direct current potential specified.



No. 300-W Filter Coil

**For Best Results Be Sure to Get  
GENUINE FEDERAL  
APPARATUS**

**Federal Telephone and Telegraph Company**

**BUFFALO, NEW YORK**



No. 650-W, Tested to 650 volts (D.C.) 1 M.F.  
No. 1000-W, Tested to 1000 Volts (D.C.) 1 M.F.

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



**THE  
Teagle  
LINE**

When you see the name  
Teagle on a radio in-  
strument you know that  
it is a better piece of  
apparatus. Send for cat-  
alog.  
Teagle Radio Division of

**THE NEWMAN-STERN CO - CLEVELAND, OHIO**

# IMITATIONS!

NAA Arlington tested Detector Crystals have won their reputation through sheer goodness—through their marvelous and uniform sensitivity—by the honesty with which they are tested, packed and guaranteed.

That there should be imitations of these nationally famous minerals is to be expected. We welcome fair competition. But unscrupulous imitations are unfair both to you, the user or dealer and to us, the pioneer producers of tested crystals.

Certain unscrupulous manufacturers are marketing so-called tested minerals in packages closely resembling the famous NAA containers.



We have obtained and tested dozens of these so-called tested crystals—some are without a sensitive spot on their surfaces—others are of mediocre quality—not one meets the rigid requirements of our testing laboratories.

We sell sensitivity, not bulk minerals. Pounds of crystals are worthless—Galena for instance, is cheap—the market price is less than 3c a lb. For crystals worthy of efficient radio use insist upon the genuine NAA (Arlington tested) Detector Crystals. For your own protection look for the signature of J. S. NEWMAN the originator, on every container. It will insure guaranteed sensitivity. Each is packed in lithographed metal container. The mounted crystals are set into brass cups and packed in enameled turned wood boxes.

NAA Galena Silicon or Goldite, price per crystal, post paid, \$0.25. Mounted, set in Woods Metal in brass cup, price per crystal post paid, \$0.40.

We will gladly replace without charge any NAA Crystal that does not function to the entire satisfaction of the user. Send for complete 80 page radio catalog describing these crystals, The Teagle Line, "Red-Head" Radio Receivers and all the leading makes of Radio Equipment. The Newman-Stern Company Cleveland, O.



**3000  
OHMS  
\$8.00**

"RED-HEADS"

THE LAST WORD IN  
RADIO RECEIVERS

at your dealers or  
send direct to

The Newman-Stern Co.  
CLEVELAND, OHIO



## RADIO PANELS AND PARTS

Start your set right. Pay particular attention to "Insulation." Get a good panel and dependable parts. To make sure that you do get them look for the dealer displaying this sign:

CONDENSITE  
**CELORON**

### RADIO PANEL SERVICE

Condensite Celoron panels and parts are right. You can bank on them, for this strong, handsome, waterproof material (approved by the Navy Department, Department of Engineering) is extremely high in surface and volume resistivity and dielectric strength. It machines readily, engraves without "feathering," and takes a beautiful natural finish—polished or dull. This is why it is so widely used for panels, tube bases, mountings, variable condenser endplates, tubes, dials, knobs, handles, bushings, etc. We can machine all of these parts to your specifications.

**Send today for our Radio Panel  
Guide**

Are you an enthusiast? This Guide describes our panels in detail—tells how they are made and what they cost.

Are you a radio dealer? Learn about Celoron Radio Panel Service and how easily and profitably it enables you to supply your customers with panels and parts fully machined and engraved to their specifications. Write for our Special Dealer's Proposition today.

**Diamond State Fibre Co.,**

Bridgeport (near Philadelphia) Pa.  
Branch Factory and Warehouse, Chicago

Offices in principal cities  
In Canada, Diamond State Fibre Co., of  
Canada, Ltd., Toronto

# Stop that Leakage!

The Willard All-Rubber Radio "A" Battery (shown at the right) is not an automobile battery adapted for Radio use, but is a special radio battery built for the reception of C W and spark messages. The reduction of the weight of connectors, the increase in thickness of plates, the special radio type of Threaded Rubber Insulation are all features that are necessary to an efficient, economical battery of this type.



You'll have to admit it's annoying to have a radio concert or a conversation interrupted by noises that sound as if all the animals in the zoo had cut loose at once.

Some of these noises can't be stopped by even the most careful tuning. They can be ended only by removing the leaky cell or the leaky battery that's responsible for them.

One of the most important features of the Willard All-Rubber Radio Battery is that it is absolutely leak-proof. Battery case and jars are cast in one solid piece of rubber, eliminating the possibility of

leakage either from cell to cell, or to ground. Every case is tested at 24,000 volts.

The Willard All-Rubber Radio Battery has the same Threaded Rubber Insulation as the Willard Threaded Rubber Automobile Battery. The Willard Radio "B" Battery is a 24-volt rechargeable storage battery, with leak-proof glass jars and Threaded Rubber Insulation. Assures freedom from frying and hissing ground noises. Ask for particulars from your dealer, or at the nearest Willard Battery Station.

**WILLARD STORAGE BATTERY COMPANY, Cleveland, Ohio**  
*Made in Canada by the Willard Storage Battery Co. of Canada, Ltd., Toronto, Ont.*

# Willard

THREADED  
RUBBER  
BATTERY

# SERVICE IS **P.W.S.** SLOGAN



**PHILADELPHIA WIRELESS SALES CORP.**  
1533 PINE STREET, PHILADELPHIA, PA.

Since 1911 the constant efforts of our personnel to render the highest possible service to manufacturers and dealers has placed us among the leaders in the Radio field.

Every article sold by us is backed by our approval, which marks it as a standard product of merit.

We cordially invite you to avail yourself of this service, whether your business is large or small.

*We will be pleased to correspond with manufacturers desiring distribution in our territory.*

## Wire Your Own— and save 25% on high-grade assembled sets

Standard radio instruments are completely machine assembled in our splendidly equipped factory. The wiring, however, is left for you to do. By buying Standard Instruments, you can get correctly assembled handsome radio instruments and at the same time save 25% or more of the cost by doing the wiring yourself. Our new 12-page folder now coming off the press, explains the Standard Plan in detail and illustrates Standard instruments in actual colors. Send 5c for your copy today in time to save money before your next purchase.

**The STANDARD Plan**  
“assembled—but not wired”

**Standard Assembling Co.**  
19 Bridge St., New York City



## POSACO

Radio Instruments of Quality  
VARIABLE CONDENSERS

Our Condensers are all made with 4 1/2" Dia. Metal Shield. Rotary plates cannot turn on shaft even should nut become loose. Furnished unmounted and in table type.

ASK YOUR DEALER OR ORDER DIRECT

|     |          |        |               |        |
|-----|----------|--------|---------------|--------|
| A-1 | 43 Plate | .001   | MFD. Capacity | \$4.50 |
| A-2 | 23 Plate | .0005  | MFD. Capacity | 4.00   |
| A-3 | 13 Plate | .00025 | MFD. Capacity | 3.50   |

Add 25c to Above prices for table type. Add 75c for Dial

Special Discount to Dealers and Jobbers

**THE C. D. POTTER CO.**

583-585 Pacific Street,

Stamford, Conn.

GREBE RADIO



"He who has heard but part of the truth"  
said Chuang Tzu,  
"thinks no one equal to himself."

Compare your present outfit with a Grebe!

Doctor My.

Licensed under  
Armstrong U. S. Patent,  
No. 1113149.



# RHAMSTINE\*

## Rheostat



**\$1.75**  
Postage 6c.

The Rhamstine\* Rheostat conveys instant and vivid conviction of value.

It is a new Rhamstine\* Product and aside from its original design and attractive appearance, it possesses these valuable features:

1. **Compactness**—the element ring is only  $1\frac{1}{4}$ " in diameter.
2. **One hole for mounting**—the bearing for the shaft also holds the rheostat frame.
3. **Brush Contact**—two stationary brushes make contact with the resistance element.
4. **Air cooled.**
5. **Noiseless.**

It is exceptionally well made, dependable and durable and quite advanced in design.

Ask your dealer to show you how it works.

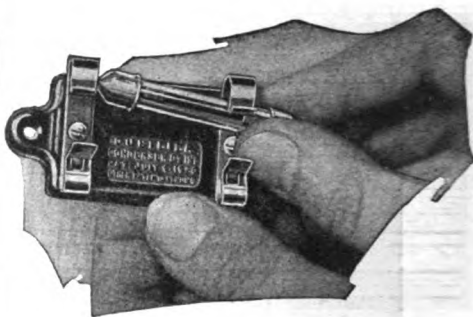
*Circulars upon request.*

Manufactured by

**J. Thos. Rhamstine\***

**2152 E. Larned St. Detroit, Mich.**

\*Manufacturer of Radio Products



## For Perfect Broadcasting Reception Use Micadon Type 600

A perfect Dubilier mica condenser, wherever employed, insures efficient receiving results.

Dubilier Type 600 Micacon, a reliable and durable condenser of permanent capacity, will last indefinitely.

Price in capacities from .0001 to .002 mfd, 75c each.

Price in capacities from .0025 to .005 mfd, \$1.00 each.

*If your dealer  
cannot supply you  
order from*

**Dubilier Condenser and Radio Corp.**

Dept. Q S  
217-219 Centre St. New York

BRANCH OFFICE,  
Munsey Building, Washington, D. C.

LICENSEES:

England--Dubilier Condenser Co., Ltd., London  
Canada--Canadian General Electric Co., Toronto  
Germany--Telefunken Co., Berlin  
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# The Book that brings Radio into the home -

## WHAT THE BOOK CONTAINS

**Section 1.—HOW RADIO ENTERS THE HOME.** Contains just the information sought by the man who wants to buy a set. What set shall I buy? How much does it cost? What will it do? This section answers a hundred such questions. All types of sets are described from the least to the most expensive. Full installing and operating instructions.

**Section 2.—HOW TO RECEIVE MOST EFFICIENTLY.** Important receiving accessories are described in language that the layman can understand. For the benefit of the amateur, technical data are given on audio and radio frequency amplification, erection of antennae, battery charging, regeneration, etc. Valuable receiving-circuit diagrams are published for the first time.

**Section 3. VACUUM TUBE TRANSMISSION FOR THE AMATEUR AND EXPERIMENTER.** Everything from A to Z about transmission with new, completely revised transmitting - diagrams, incorporating Radiotron transmission and Kenotron rectification. Valuable operating instructions are given, and the use of mica condensers for transmission is emphasized.

**Section 4.—GENERAL INFORMATION — A VERITABLE GUIDE BOOK TO RADIO.** Government laws, National Electric Code Radio Rules, vacuum-tube "Don'ts," radio glossary, specifications for a scientifically constructed amateur station, complete price list of all R C A equipment.



Price  
35c.

**F**OR the first time a book is published at a small price which gives the public all that it should know about radio. It is called "Radio Enters the Home," and it is written by experts. It tells how to enjoy popular radio broadcasting, and it gives complete descriptions of apparatus and installation instructions. No book so richly illustrated, so accurate, and yet so understandable has thus far been published.

The book is divided into four sections. Over 200 illustrations, 112 pages, size 8"x11". The technically uninformed man will find in sections written especially for him the simply presented fact that he seeks; in other sections are data and diagrams that appeal to the trained amateur.

PRICE, AT YOUR DEALER.....35 cents

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Electrical Instruments, Meters and Circuit Breakers



MAIN OFFICE:  
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*Offices in principal cities in United States and Canada*

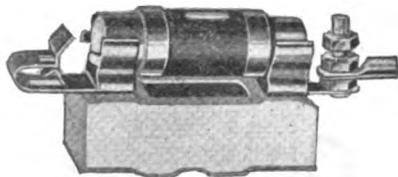
## BRACH vacuum LIGHTNING ARRESTER

*Guards Your Radio Like a Sentinel,  
Day and Night.*

Every lightning flash fills the air with static which has its potential dangers to every radio and home unless they are protected by the BRACH Vacuum Lightning Arrester.

This unflinching sentinel requires no attention—it is on the job all the time, does not have to be switched and cannot become grounded.

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16 Years Specialists in Lightning Protective Apparatus.

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**NOISELESS — DEPENDABLE —  
GUARANTEED**

All Standard Sizes—Plain and  
Variable

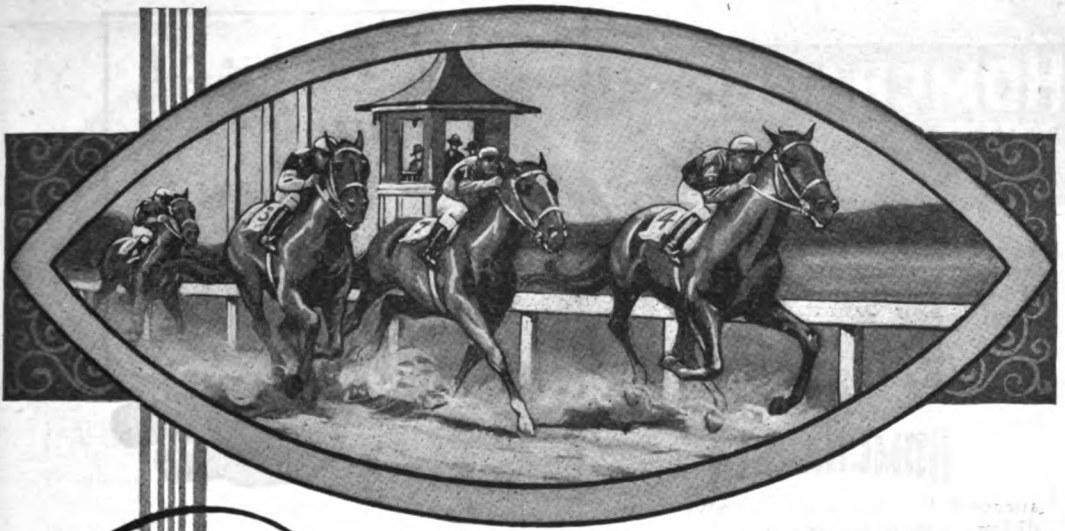
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*We're off!!!*



OFF THE beaten path and on the trail to a worthwhile goal. "Thoroughbred Apparatus" has been constantly winning new friends and has hung up some enviable records as a quality leader in radio apparatus.

Our goal is, *unwavering superiority* and we intend to come under the wire *with* "Thoroughbred Apparatus" in the lead of the radio field.

On June 1st we moved into our new factory. Now, with greatly increased facilities, we are prepared to handle your orders as they come. Write for our interesting offer to reliable dealers.

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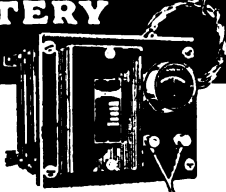
Jackson and N. 12th St.,

Toledo, Ohio

***Thoroughbred Apparatus***

# HOMCHARGE YOUR BATTERY *for A Nickel*

No muss, trouble,  
dirt—no moving  
of batteries—loss  
of time—no ef-  
fort on your part  
—no technical or professional knowl-  
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successfully meets all charging con-  
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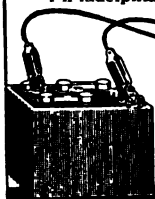
1. S-1<sup>c</sup> polarizing. Connect battery either way and it will always charge. No danger of reverse charging, ruined battery or burnt out Rectifier.
2. No delicate bulbs to break or burn out. Only one moving and two wearing parts. These are replaceable as a unit, after thousands of hours use, at small cost. Cannot be injured by rough handling.
3. Operation stops and consump-  
tion of current ceases immediately upon disconnecting battery.
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5. Highest efficiency of any three or six cell charger made.
6. No danger of fire. Approved by the Underwriters.

### ATTENTION MOTORISTS

Will charge your auto battery as well as radio battery. Send for Bulletin No. 58 for further information.  
For sale by all radio, electrical and accessory dealers or shipped express prepaid for purchase price .....\$18.50  
\$20 West of the Rockies

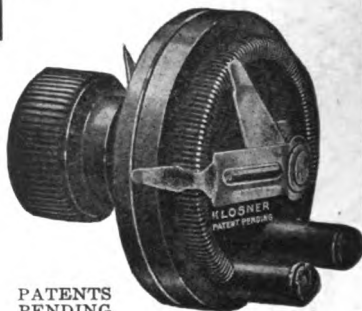
**The Automatic Electrical Devices Co.**  
127 West Third St., Cincinnati, Ohio.

Branch offices: New York, Chicago, Pitts-  
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*Largest Manufacturers  
of Rectifiers in the World*

*Protect  
your VT's*



PATENTS  
PENDING

# KLOSNER *Vernier* RHEOSTAT

**EVERY TUBE** you have de-  
serves a Klosner Vernier  
Rheostat. The Klosner **WIRE**  
**WOUND** feature produces a  
low starting current prevent-  
ing sudden strain and thereby  
prolonging the life of the tube.

The Klosner provides mi-  
crometer adjustment for your  
critical detector tubes. One  
single knob controls both the  
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It is unsurpassed for loudest  
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The cost is no more than for  
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Boston Road, New York City.

*Dealers: This is the fast-  
est moving rheostat on the  
market. It is stocked by  
all leading jobbers. Get  
your supply from them.*

**One Single Knob  
No Sudden Strain  
\$1.50**



# A Word of Warning To Readers of QST

WAS P. T. Barnum right? Barnum, famous old circus man, had a motto:

"Get their money and get them out of the big tent."

All of which might have been very well in his day, and for the circus business. But it won't go today—in Radio.

Look for this name "SIGNAL" on your Radio material.

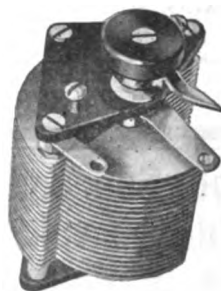
TOO many mushroom Radio makers who have come up overnight follow Barnum's dictum to get their money and get rid of them.

Too much Radio equipment is built to *sell* to a Radio crazed public, eager for "anything new". The big question is: How can the sincere amateur and advanced beginner *know* the real worth of *his* Radio purchase?

The answer is: By the name on the apparatus, by what the name stands for, has stood for in wireless and radio for years back; By what professionals and experts say about material branded with that name.

## SIGNAL RADIO EQUIPMENT


is built for service, by Signal workmen in the Signal factory. Every SIGNAL product was designed and developed in Signal laboratories and is guaranteed high quality in materials and workmanship. During the war Signal saw real service. Today Signal is serving professional and commercial radio users as well as advanced amateurs everywhere. This is your assurance.



Signal Condensers No. 76-77 are rigidly built. Instead of using aluminum but .015" in thickness for the plates, as is usual with ordinary amateur construction, Signal plates are .026" thick.

## SIGNAL ELECTRIC MANUFACTURING COMPANY

Menominee, Michigan

Use this request-coupon to secure latest SIGNAL Bulletins. Fill out and mail today.   
Put your radio problems up to us.

### COUPON

Send me the new Signal Wireless Bulletin W.

Name .....

Company .....

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# DON'T IMPROVISE—PACENTIZE



**Pacent Twin  
Adapter**

Makes one jack take  
two plugs.

Cat. No. 51

Price \$1.50

USE



RADIO ESSENTIALS

CONVENIENCES YOU NEED

The *original* products of their kind.  
Backed with 15 years Radio experience.  
Standard with largest radio manufacturers.  
Indispensible for convenience and service.

**Pacent Universal Plug**

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**Pacent Standard VT Batteries**

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See Your Dealer or Send for Bulletins Describing Pacent Radio Essentials

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INCORPORATED

150 NASSAU ST.,

NEW YORK, N. Y.

CHICAGO, ILL.

WASHINGTON, D. C.

PHILADELPHIA, PA.

*Member Radio Section, Associated Manufacturers of Electrical Supplies.*

## Buy Your Sots and Parts from the Oldest Exolusivo Radio Storo in Now England!

UNIT "B" BATTERIES  
45V Variable ..... **\$3.60**

CARBON RHEOSTATS  
Adjust to .01 Amp ..... **\$1.50**

PHONES HOLTZER-CABOT  
2200 Ohms ..... **\$8.00**

KEYSTONE LIGHT'G ARRESTORS **\$1.75**

600V-100A LIGHT'G SWITCHES  
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*We carry at all times a complete stock  
of standard parts at standard prices.  
Complete Line of Frost Jacks and Plugs.*

**RADIO EQUIPMENT CO.**  
630 Washington St. Boston, Mass.  
MAKERS OF THE RADECO SAFETY FUSE

## JOY-KELSEY CORPORATION

Manufacturers of  
**RADIO EQUIPMENT**

**4021 Kinzie Street**  
**Chicago, Illinois**

# WESTINGHOUSE

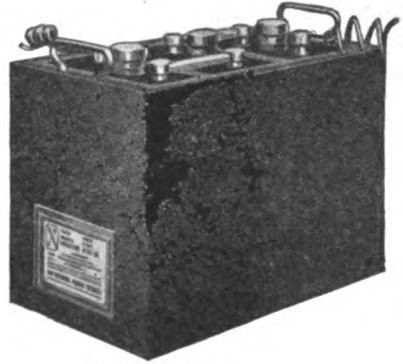
## RADIO

# BATTERIES

**Eliminate all Battery Troubles from Radio Sets**

The Westinghouse "A" Battery is a full capacity, low voltage slow discharge, long-life storage battery built exclusively for radio work.

For "B" battery requirements Westinghouse has perfected a baby storage battery. No more throwing away exhausted cells. No more continuous "B" battery expense.



The Westinghouse "B" is a permanent battery. It never has to be replaced. It will discharge its load with constant, steady voltage. Then it can easily be recharged. It gives continuous service to the point of exhaustion without growing "scratchy." If your vacuum tube is inclined to be noisy you can adjust the contact on the Westinghouse "B" to take off the exact voltage the V.T. requires.

Get a Westinghouse "A" and "B" from your dealer or the nearest Westinghouse Battery Service Station and eliminate all your radio battery troubles.



14  $\frac{3}{4}$  in. long  
2  $\frac{1}{2}$  in. wide  
3  $\frac{3}{4}$  in. high

**WESTINGHOUSE  
UNION BATTERY CO.**  
Swissvale, Pa.

*"The best  
Westinghouse  
can build."*



## Thousands of Unfilled Orders for the **TELMACOPHONE**

### *What's The Reason?*

Much to our regret we have been unable to fill all orders for the Telmacophone promptly. The demand has been far beyond our expectations. When we first advertised the Telmacophone, we felt confident that it was the *greatest value ever offered*.

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Price  
Complete \$20.00

Fully  
Guaranteed

**DEALERS!** We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

Radio Division  
**TELEPHONE MAINTENANCE CO.**

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Note New Address  
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Chicago, Ill.

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We represent all the leading manufacturers and can make immediate delivery on most anything in the **RADIO LINE of TODAY.**

A trial of our **SERVICE** will convince you.

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Send 5c for a copy of our catalog

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## **RAYMOND RADIO CORPORATION**

Manufacturers To the Radio Industries

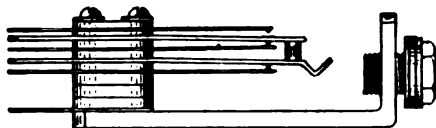
V. T. Sockets  
Rheostats  
(Plain And Vernier)  
Variable Condensers  
Etc.

Executive Offices:  
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New York City  
Works:  
Farmingdale, L. I.

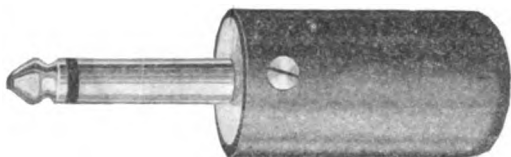
Control Panel Units  
Crystal Detector Sets  
Vacuum Tube Sets  
Storage B Batteries  
Etc.



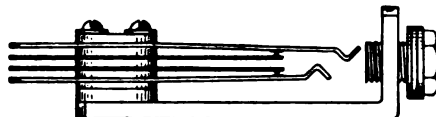
# FROST RADIO PLUGS and JACKS



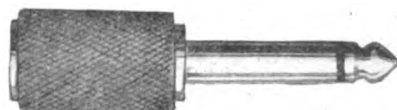
**No. 136—Jack only, \$1.25**



**No. 137—Plug, \$1.25**



**No. 131—Jack only, \$0.90**



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Buy Plugs and Jacks designed for radio use. FROST RADIO PLUGS AND JACKS are the smallest, neatest and most perfectly finished. Terminals are "spread" and tinned, making the soldering of wires a pleasure. Two-color Posters ready for distribution.

Attractive proposition for Jobbers and Dealers.

Made in all types, both plain and filament control, and interchangeable with any Standard Plug. We are ready to give immediate deliveries from stock, and can furnish any quantity up to ten thousand within a week after receipt of order.

## Frost Fones—A Quality Achievement



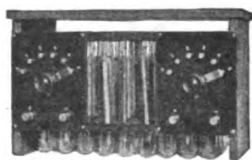
**Frost Fone No. 162 \$5.00**

For the price, it's the best buy on the market. Test 'em out with your pet and be convinced. Prompt deliveries, and attractive Dealer discounts. Write for full information.

We solicit Dealer inquiries for all standard Radio materials.

**WIRELESS MFG. CO., CANTON, OHIO**

EXCLUSIVELY WHOLESALE



# Storage Batteries

designed for

# RADIO



## KICO "B" BATTERY

## KICO "A" BATTERY

### FACTS ABOUT KICO STORAGE "B" BATTERIES—

1. Not an ACID "B" Battery.
2. They eliminate noises caused from "Bs" that are rapidly deteriorating.
3. The switch control allows single cell variations from 12 volts up. (A critical plate adjustment is essential on your detector bulb for C.W. and Radiophone reception.)
4. Rechargeable from your 110 volt A.C. line in connection with the rectifier supplied with each battery.
5. Will last from three to six months on a single charge while in the detector plate circuit.
6. NOT an experiment. All batteries are sold with the privilege of receiving your money back if unsatisfied.
7. Neat, Efficient and Compact.
8. Unlimited life.

|          |           |
|----------|-----------|
| 16 cell  | 22 volts  |
| 24 cell  | 32 volts  |
| 36 cell  | 48 volts  |
| 50 cell  | 68 volts  |
| 78 cell  | 100 volts |
| 108 cell | 145 volts |

| Plain  |
|--------|
| \$6.50 |
| 8.00   |
| 10.00  |
| 12.00  |
| 16.00  |
| 21.00  |

| With Panels |
|-------------|
| \$12.00     |
| 14.00       |
| 17.00       |
| 21.00       |
| 26.00       |

*Literature gladly furnished.*

**KIMLEY ELECTRIC CO., 290 Winslow Ave., BUFFALO, N. Y.**



## BINDING POSTS

Large stock of these exceptionally well made binding posts with unremovable heads. Let us quote prices on the quantity you can use.

## Radio Supply Service UP-TO-THE-MINUTE

The radio dealer needs a new kind of jobber service to meet the demands of a new and different business. North Ward Service is developed especially to meet this need. Give it a trial.

### JACKS

- #30 Single Circuit Open
- #32 Double Circuit Close
- #31 3 Spring Automatic
- Filament Control
- #33 5 Spring Automatic
- Filament Control

### Fixed Condensers

- Switch Lever
- Duplex Adapter
- Complete Crystal Sets
- Crystal Detectors
- Double-Slider
- Tuning Coils
- Coils

Distributors for The New Brandes  
"Superior Type Matched Tone" Headset

Get our Prices and Discounts.

**NORTH WARD RADIO CO.**

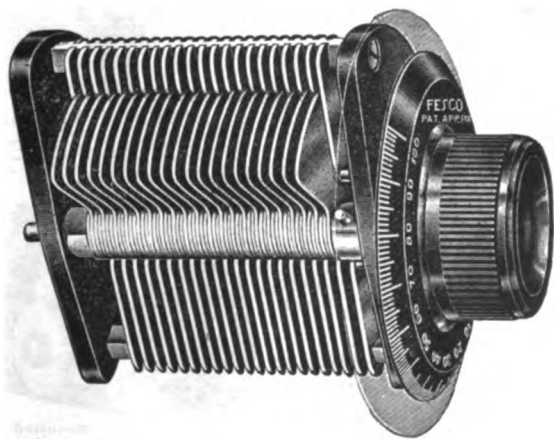
72A Orange St., Newark, N. J.



Send 10c for Sample  
Copy

Suite 10  
11 St. Sacramento Street,  
Montreal

# CONDENSERS



|               |        |
|---------------|--------|
| 3 Plate.....  | \$2.25 |
| 11 Plate..... | 3.25   |
| 23 Plate..... | 4.00   |
| 43 Plate..... | 4.75   |

Add 75c to above list for condenser with dial.

## CAPACITY

|                   |        |
|-------------------|--------|
| 3 Plate vernier.. | .00004 |
| 11 Plate.....     | .00025 |
| 23 Plate.....     | .0005  |
| 41 Plate.....     | .001   |

Each condenser is equipped with ground shield which eliminates all hand capacity losses. No accumulated error due to poorly cut spacing washers.

## BAKELITE DIALS BAKELITE

Furnished in either 3/16 or 1/4 inch shaft sizes. 3" outside diameter with large and clear numerals. 0-100 degrees.  
Price .....\$1.10



This dial is made of genuine bakelite and is guaranteed not to warp. The knob is knurled to prevent slipping of fingers.  
Price .....\$1.10

## STERN & COMPANY, Inc.

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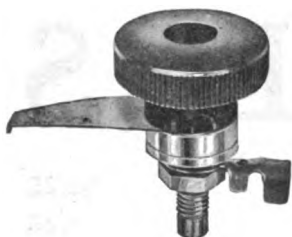
Hartford, Conn.

Catalog 10c.

F E S C O

Dealers Propositions  
Entertained

## USE WIS-WIN Switches



#750—1 1/4" Radius  
#752—1" Radius  
**PRICE 55c EACH**



#751—1 3/8" Radius  
#753—1" Radius  
**PRICE 30c EACH**

A chain is as strong as its weakest link. Get the most out of your set by using "WIS-WIN" switches.

Unit assembly, concealed spring tension, self-cleaning contact, highly polished nickel parts. Template for drilling contact holes furnished with each switch.

*If your dealer cannot supply you, we will ship direct, postpaid, upon receipt of price.*

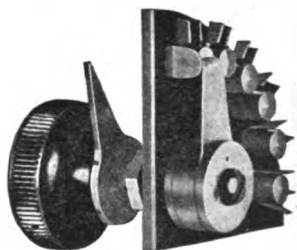
### Interesting Trade List

Manufacturers, we make switches for special requirements. Send us your specifications.

**Willis Switch & Instrument Co.**  
8 Kingsbury St.  
Jamestown, N. Y.



#754—1" Radius  
**PRICE 65c EACH**



Switch points mounted in Formica sector for back panel use. Requires only one hole in panel to mount.

#756—Inductance  
#758—"B" Battery  
**PRICE \$1.25 EACH**

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Kellogg .....\$1.00  
Crosley ..... .60  
Murdock ..... 1.00

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Fada .....\$1.00  
Crosley ..... .60  
Bradleystat ..... 1.85  
Framingham ..... 1.00  
Howard ..... 1.10  
B. Battery 22 1/2 v. 1.75

### V.T.'s

Radiotron 200 ....\$5.00  
Radiotron 201 .... 6.50  
A. P. Amplifiers.. 6.50

### AMPLIFYING TRANSFORMERS

J-Ray unmounted..\$3.75  
J-Ray mounted... 4.75  
Thordarson mtd... 4.50

### SWITCH LEVERS

J-Ray nickeled...\$0.40  
Premier nickeled.. .60

### VARIOMETERS

J-Ray K-D .....\$4.00  
Unwound ..... 2.00  
National, assembled 5.00  
Variaset (2 variometers 1 coupler) 10.00

### DIALS

J-Ray White  
Enameled .....\$1.00  
Bakelite Dials... 1.00

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Manhattan 2000  
ohms .....\$6.00  
Stromberg-Carlson  
2000 ohms .... 7.50

### VARIABLE CONDENSERS

34 plate .001 mfd. \$4.80  
23 plate ..... 3.95  
**LOUD SPEAKERS**  
J-Ray Aluminum \$3.50  
Magnavox ..... 45.00

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Formica 18 1/2 x 7 x  
1/8 .....\$2.25  
9 1/4 x 7 x 1/8 ..... 1.15  
Cabinets to fit \$6.50  
and \$2.85.

Switch Points, Complete Receivers, Binding Posts, all leading makes carried.

**J-RAY MFG. CO.**

Write for Bulletins.  
1618 Chestnut St.,

**ST. LOUIS, MO.**

## Radio Frequency Transformers



Type RT-1, for the amateur and broadcasting range, 175-500 meters.  
(Patent Pending)

**\$6.00**

*Will work on all tubes.*

The only completely shielded iron-core  
R. F. Transformer.

**RASLA SALES CORPORATION**

10 EAST 43d ST.,

National Distributors for Radio Service Laboratories, Inc.



**NEW YORK CITY**

## 14 YEARS OF KNOWING HOW

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PRICES—2000 OHM \$5.00—3000 OHM \$6.00

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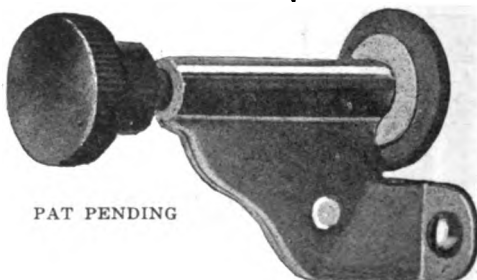
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# THE VERNIER ADJUSTER

PRICE \$1.50

Practically  
Eliminates  
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Permits a  
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PAT PENDING

TYPE 100

Easily and  
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WE HAVE AN UNUSUALLY INTERESTING PROPOSITION FOR YOU  
The Vernier Adjuster is an absolute necessity and our advertising cam-  
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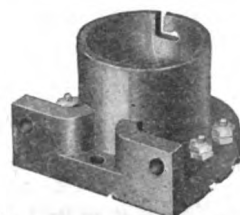


"Benwood Variometer"

A PROPERLY designed variometer brings in signals very much louder and clearer than the various other types of inductances on the market. With this fact in mind we have designed the "last word" in variometers—the "Benwood". Inductances are wound with double cotton covered wire and no shellac, paint or varnish is allowed to cover the wire and diminish the effectiveness. The "Benwood" features are—minimum distributed capacity, minimum distance between stator and rotor, large size wire on both coils, positive contact bearings, and proper design. This variometer will get splendid results on wave lengths from 150 to 650 meters with **\$5.00** the average variocoupler. Price, each.....

## "Benwood" Vacuum Tube Socket

HERE is the very latest and best improvement in vacuum tube sockets—the new "Benwood". Solid, highly polished, molded Bakelite, specially designed for either base or panel mounting—the only one of its kind. Firmly holds any standard four-prong detector or amplifier tube. Eliminates ground hum and noises in operation of amplifiers. Terminal posts plainly marked. Base is  $2\frac{3}{8} \times 2\frac{3}{8}$  inches, height  $1\frac{1}{2}$  inches. A good buy at..... **\$1.00**



"Benwood" V. T. Socket



"Benwood" Dial Control

## The New, Improved "Benwood" Dial Controls

THE "Benwood" controls all have solid Bakelite knobs of extra large diameter, which minimize all body capacity effects, and the new tapered design fits the fingers perfectly. The knurling is particularly fine and sharp.

### Solid Bakelite Knob and Dial

Graduated  $0^\circ$  to  $100^\circ$ —all markings clearly defined in white and stamped into the solid Bakelite—won't wear off. Stops on reverse side prevent turning too far. Set screw deeply countersunk and easily reached.

|                        | Diam.            | Depth            | Knob             | Each           |
|------------------------|------------------|------------------|------------------|----------------|
| BC-7 "Benwood" control | 4"               | $1\frac{1}{8}$ " | 2"               | at base \$1.75 |
| BC-8 "Benwood" control | $3\frac{1}{4}$ " | $1\frac{1}{8}$ " | $1\frac{1}{2}$ " | at base 1.50   |

Specify whether 1-4 inch or 3-16 inch drilling is required.

**CATALOG**—send 10 cents in stamps for the Benwood catalog and price list, also complete catalog and price list of DeForest Radio Equipment.

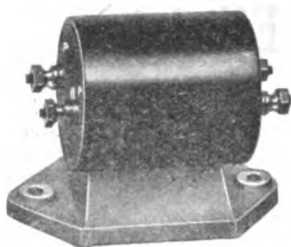
**DEALERS**—We manufacture high grade radio apparatus in our own factory and have stock ready to ship. Write or wire for our liberal dealers' discounts. New price and discount sheet issued June 15th.

## Bakelite Binding Post

THESE "Benwood" binding posts have the same style tapered, knurled solid Bakelite grip which fits the finger tips and matches the "Benwood" dial controls. Diameter  $\frac{20}{32}$ -in. Complete with two washers, each **20c**



The **BENWOOD** Co. INC.  
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# THE EXCEL Radio Frequency Transformer



WAVELENGTH RANGE  
200-600 Meters

Complete With Instructions

Price \$4.50

NO POTENTIOMETER REQUIRED  
NO HOWLING OR HISSING  
DOES NOT IMPAIR NORMAL OPERATION OF YOUR REGENERATIVE  
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10 TO 15 TIMES AMPLIFICATION PER STAGE AT BROADCASTING  
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USE WITH RADIOTRONS OR A. P. TUBES  
IDEAL FOR LOOP RECEPTION

With two stages of EXCEL transformer coupled amplifier and detector, WJZ is heard with an audibility of 200 on a 4 foot loop at our factory. The outstanding advantage of the EXCEL transformer is that it can be connected in the circuit just like an audio frequency transformer. Its stability results from the fact that it amplifies by true voltage amplification instead of by partial regeneration.

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Broadcasting Stations

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**For Best Results Use the Stromberg-Carlson Radio Headset**



Stromberg-Carlson  
No. 2A Headset

**\$7.50**

The Stromberg-Carlson No. 2-A Headset reproduces broadcasted, long-distance vocal or musical sounds with unequalled distinctness. Fine tonal qualities, extreme sensitiveness and superior construction are its important features.

Order Above and Following Highest Grade Supplies by Mail  
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| DeForest 2 Stage Amplifier DT 800 less Bulbs and Batteries.....   | 34.00   |
| Simplex Variometers.....  | 5.00    |
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| UV 201 Radiotron Detector Bulbs each.....                         | 6.50    |
| No. 766 Eveready VT Batteries, each.....                          | 2.00    |
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Loose Leaf System, Amateur, Special, Experimental, Technical, Telephone Broadcasting, etc., kept to date monthly.

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## Specifications

**Receiver Case**—Aluminum.

**Coils**—Wound with highest grade enamelled insulated copper wire.

**Resistance**—2200 ohms.

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**Magnet**—High percentage Tungsten Steel—permanent.

**Diaphragm**—Rust-proof.

**Cord**—Six foot.

**Head Band**—Approved spring wire—self-adjusting, sliding rod type.

**F**AITHFULLY reproduces all broadcasted musical and spoken sounds. This set is unequalled for tonal quality and perfect balance of the receiver.

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## EISEMANN MAGNETO CORPORATION

Radio Division

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*See August issue for interesting announcement of other Eisemann Radio Equipment*

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Catalogue will be mailed for ten cents in stamps

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ALL over the world "Dictograph" stands for the finest and most sensitive equipment made for transmitting and receiving sound. The Dictograph Radio Head Set is the product of the same experience, that had made the Detective Dictograph, the Acousticon for the Deaf and the Dictograph System of Telephones, the world's standard for sensitive receiving, scientific accuracy and fine construction.

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Ready Soon—the Dictograph Radio Loud Speaker.

**3000  
Ohms**



**Price  
\$12**

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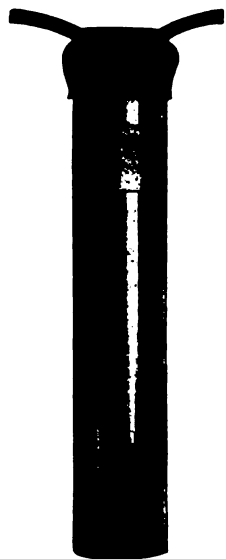
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## New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

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Add PP on  $\frac{1}{2}$  lb.  
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Cut shows cell one half natural size.

Voltage per cell 2 volts.

Pasted Plates—ready formed for initial charge.

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Shipped dry with simple directions for preparing the electrolyte.

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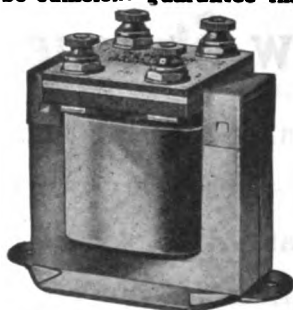
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That should be sufficient guarantee that it is right



**SHELL  
TYPE**

**PRICE  
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Each transformer supplied fully mounted in an ingenious, nickered frame with substantial terminals mounted on a bakelite terminal board.

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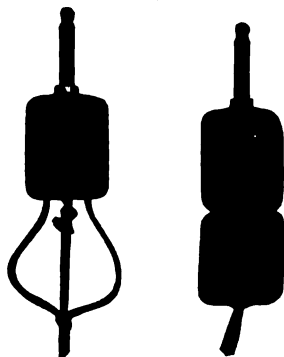
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## Complete Radio Enjoyment



No. 2-A Radio Head Set  
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No. 147 Radio Jack \$0.85



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STROMBERG-CARLSON "Radio Jacks" are adapted to all standard Radio Plugs. They mount neatly without washers, on panels of varying thickness between  $\frac{1}{8}$ " and  $\frac{1}{4}$ ".

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They Charge Automatically Operating Unattended. Leave Battery where it is, without even disconnecting it; Screw Plug in Lamp Socket, Snap Clips on Battery Terminals; Turn Switch & Battery will be Charged in the Morning. Is it not gratifying to feel that Your Radio Batteries will never fail & You are Always Ready to Receive Radiophone Broadcast Music Speech & News never having to be careful of or have to tell Friends that your Batteries are dead. F-F Battery Boosters are Complete Compact Self-Contained Portable Full Wave Automatic Magnetic Rectifying Charging Units, for 105-125 Volt 60 Cycle A.C. No Skill is Required. Infusible Carbon Rectifying Brushes Maintain Uninterrupted Service. They Save You 90c. a Charge & Last a Lifetime. **REDUCED PRICES:** Type 6 Charges Radio "A" 6 volt Battery At 6 amperes \$15 Type 6 Charges Radio "B" Batteries Up to 100 volts \$15 Type A-B Charges Both Your "A & B" Radio Batteries \$20 Type 12 charges 12 volt Battery At 5 amperes \$15 Type 166 charges 6 volt Battery At 12 amperes \$24 Type 1612 charges 12 volt Battery at 7 amperes \$24 Type 1626 is a Combination of Both Types 166 & 1612 \$36 All Types but Charge Auto Batteries. The larger types are for heavy Batteries or Where Time is limited. Shipping Weights 11 to 15 lbs. Purchase from Dealer, or Mail Check for Prompt Shipment. If via Parcel Post add Postage & Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge Batteries from Farm Lighting Plants & D.C. Circuits & For GROUP CHARGING use our 12 Battery 8 Ampere Full Wave Automatic ROTARY Rectifier Described in FREE Bulletin No. 31A Order Now or Write Immediately for Free BULLETIN No. 31

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THE

## Pioneer

- 1915 First regenerative receiver ever manufactured bore the name PARAGON.
- 1916 First Trans-continental Amateur Reception (California from New York; not pre-arranged) effected with a PARAGON Type RA-6 Receiver.
- 1916 First Trans-continental Amateur Transmission (New York to California; not pre-arranged) effected by PARAGON designed transmitter.
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**FIRST TESTED THEN SOLD**

## JEFFERSON Amplifying Transformers



No. 45

BY ACTUAL TEST JEFFERSON Amplifying Transformers have proven superior to anything now on the market. Try them and note the improvement, the absence of distortion and the clearness of tone.

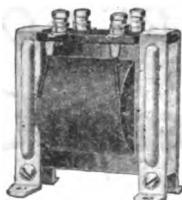
FURNISHED IN TWO TYPES, either mounted or unmounted. Wound with No. 40 and No. 44 wire on a core of highest grade 36 gauge Silicon steel.

Send for Radio Bulletin

REASONABLY PROMPT DELIVERIES

**Jefferson Electric Mfg. Co.**

425 S. Green St., CHICAGO



No. 41

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In Stock for Delivery—NOW

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| U.V. 200 Detector    | \$5.00     |
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Also a large stock of all necessary parts for making your own sets.

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(THUNDERPHONE)

TRADE MARK REG. U.S. PAT. OFFICE

**Will Bring America's Popular  
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Model K400

Loud speaking receiver. Thorophone is attached to the bottom of the base and is concealed from view yet easily accessible.



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This beautiful instrument gives you the desired volume, and tone of exquisite quality and musical excellence.

**\$35.00  
Complete**

Winkler-Reichmann Co., America's OLDEST manufacturer of Loud Speaking Telephones, offers the THOROPHONE for RADIO CONCERT WORK as its latest success.

In bringing out the THOROPHONE with Concert Horn—beauty and clarity of tone—ample volume—and mechanical perfection have been made outstanding features of design.

Lay aside your head receivers—invite your friends in—enjoy with them a real musical treat. Use the THOROPHONE also for detecting and tuning.

The Thorophone requires better than the average radio receiving set to give a great, big powerful volume, but just give it the power and its musical qualities will astonish you.

THOSE DESIRING TO USE THEIR OWN PHONOGRAPHS CAN DO SO BY ATTACHING OUR ADAPTER WITH THOROPHONE DIRECT TO PHONOGRAPH TONE ARM.

### The Loud Speaking Receiver— THE THOROPHONE

Has a controlled mica diaphragm, and carefully designed sound box nickel plated throughout. Does not use up your storage battery. Simply connect it on in place of your head receivers.

#### THOROPHONE

Model K400—\$20.00

Phonograph adapter extra

Model 350— .40

### THE CONCERT HORN

Is a beautiful musical instrument, highly ornamental to any home. The base and tone arm are of mahogany finish wood, the neck of heavy metal and the bell of extra heavy spun aluminum. It has great brilliancy, WITHOUT METALLIC TONE.

#### CONCERT HORN

Model H300—\$15.00

Height 25 inches.

## WINKLER-REICHMANN CO.

4801 South Morgan St.,

Dept. Q

Chicago, Illinois

DEALERS: We have a REAL loud speaker and a REAL proposition for you.

**A.R.R.L.**  
Ontario  
Division

**Wireless**  
Association  
of  
Ontario

# A.R.R.L. MEN

NOTE

## FIRST CANADIAN NATIONAL CONVENTION— EXHIBITION OF RADIO ENTHUSIASTS

AT

PRINCE GEORGE HOTEL

TORONTO, CANADA

### September 8 and 9, 1922

This Is a Chance to Meet Your Canadian Brothers. Banquet Arranged for  
Saturday Evening, 9th Sept. Being Held During the Last Two  
Days of the

### CANADIAN NATIONAL EXHIBITION

Offers You the Oppertunity of Seeing the Largest Annual Exhibition in the World,  
And Then Take in the Big

### RADIO CONVENTION

Write For  
Accommodation  
E. J. Bowers (3CZ)  
37 Lowther Ave.  
Toronto

Reservations  
For Display  
W. C. C. Duncan (9AW)  
196 Ellsworth Ave.  
Toronto

**Wireless**  
Association  
of  
Ontario

**A.R.R.L.**  
Ontario  
Division

## Hygrade Specials

### SAVE YOU MONEY

|   |        |
|---|--------|
| No. 766 Eveready 22½ volt large Variable B. Battery and Eveready Volt Meter | \$3.00 |
| 45 volt Cyclone large Variable B. Battery                                   | 2.75   |
| Binding Posts (rubber cap), per dozen                                       | .75    |
| Electrose Insulators, per dozen   | 2.00   |
| 3-inch Bakelite Dials   | .75    |
| 7-Stranded Copper Aerial Wire, 100 ft.                                      | .65    |
| Arkay Loud Speaker  | 4.00   |
| Bakelite V. T. Sockets  | .65    |
| Fada Rheostats  | .90    |
| Klosner Vernier Rheostats   | 1.25   |
| .001 M.F. Signal Variable Condenser with Dial                               | 4.50   |
| Thordarson Amplifying Transformers  | 3.98   |
| Everett 3000 Ohm Head Set   | 6.95   |
| Dictograph 3000 Ohm Head Set  | 9.95   |
| Federal 2200 Ohm Head Set   | 7.25   |
| Western Electric Head Set (Navy Type)                                       | 13.50  |
| Homcharger—Rectifier  | 16.75  |

### MARKO STORAGE BATTERIES

|                                      |         |
|--------------------------------------|---------|
| 6 volt, 30 amp., guaranteed 2 years  | \$10.00 |
| 6 volt, 60 amp., guaranteed 2 years  | 13.50   |
| 6 volt, 80 amp., guaranteed 2 years  | 17.00   |
| 6 volt, 100 amp., guaranteed 2 years | 21.00   |

We do not charge for crating. Above batteries are fully charged when shipped.

Above prices are F. O. B. New York

**Hygrade Electrical Novelty Co.**  
41 West 125th Street  
Dept. S. NEW YORK

**B K U M A** Trade  
Mark  
Reg't'n  
Ap. For **YRLSBUG**

**MEMORIZE CODE**  
Almost Instantly  
**ATTENTATIVE BEGINNERS**  
Who Use  
**DODGE ONE DOLLAR**  
**RADIO SHORT CUT**  
**DO ARRIVE**

**WILLIAM N. ADLER (2BGC),**  
576 East 143 St., New York.  
MEMORIZED CODE IN 40 MINUTES QUALIFIED  
FOR LICENSE AFTER TWO WEEKS PRACTICE.

**J. ROBERT ZIEGLER (3AIO),**  
129 Dauphin St., Lancaster, Pa.  
MEMORIZED CODE IN 30 MINUTES QUALIFIED  
FOR LICENSE AFTER ONE WEEK PRACTICE.

### INVESTIGATE

**C. K. DODGE, Box 210, MAMARONECK, N. Y.**

**SHIP OWNERS**  
**RADIO SERVICE**  
**INC.**

80 Washington Street, New York City

**Radio Distributors**

# RADIO APPARATUS

*Distributors of Reliable Radio Apparatus to Schools, Colleges, Radio Clubs and Experimenters all over the World!*

**"PITTSO"**

**Specializing on "RADIO  
CORPORATION'S"  
Products**



**"PITTSO"**

**Now has three Stores.  
Send us your orders!**

The present tremendous demand for Radio Apparatus has practically made it impossible for us to render our usual SERVICE. Reasonably prompt delivery, however, can be made on the items listed

## AMPLIFYING TRANSFORMERS

|  |        |
|--|--------|
| No. P-1 General Radio, semi-mounted..... | \$5.00 |
| No. 50 Chelsea, semi-mounted.....        | 4.50   |
| No. A-2 Acme, semi-mounted.....          | 5.00   |

## ANTENNA WIRE

|   |      |
|---|------|
| "Pittsco" #14 hard drawn copper, (80 ft. per lb.) per lb..... | .40  |
| 500 ft. (Special value).....                                  | 2.25 |
| "Pittsco" 7 strand #22 tinned copper, per ft.....             | .01  |
| 500 ft.....   | 4.00 |
| 1000 ft.....  | 7.50 |
| "Pittsco" 7 strand #20 Phosphor bronze per ft.....            | .02  |
| 500 ft.....   | 7.50 |

## ANTENNA INSULATORS

|   |     |
|---|-----|
| No. P-1 Electrose Ball insulator.....           | .35 |
| No. P-2 Electrose 4 inch strain insulator.....  | .45 |
| No. P-3 Electrose 10 inch strain insulator..... | .75 |

## "A" BATTERIES (Storage Batteries)

|  |       |
|--|-------|
| Yale 6 volt 60 Ampere-hours.....   | 18.00 |
| Yale 6 volt 80 Ampere-hour.....  | 21.00 |
| Yale 6 volt 100 Ampere-hour.....   | 25.00 |
| Note—These batteries are shipped carefully crated and fully charged ready for use. |       |

## "A" BATTERY RECTIFIERS

|  |       |
|--|-------|
| No. P-1 Tungar, 5 ampere type, complete with bulb..... | 28.00 |
| No. P-2 Tungar, 2 ampere type, complete with bulb..... | 18.00 |
| No. P-3 F. F. Battery Booster, 5 ampere type.....      | 15.00 |

## "B" BATTERIES

|   |      |
|---|------|
| No. 763 Eveready, 22.5 Volt, small size.....                  | 1.75 |
| No. 766 Eveready, 22.5 Volt, large size 16½ to 22½ Volts..... | 3.00 |
| No. 774 Eveready, 43 Volt, large size Variable.....           | 5.00 |

## CRYSTAL RECEIVING SETS

|   |       |
|---|-------|
| Aeriola Jr. Westinghouse, complete with telephones..... | 25.00 |
| Everyman DeForest, complete with telephones.....        | 25.00 |

## CONDENSERS (Variable)

|  |      |
|--|------|
| No. 1 Chelsea fully mounted, .001 Mf.....                      | 5.00 |
| No. 2 Chelsea fully mounted, .0005 Mf.....                     | 4.50 |
| No. 3 Chelsea unmounted with dial .001 Mf.....                 | 4.75 |
| No. 4 Chelsea unmounted with dial .0005 Mf.....                | 4.25 |
| No. 367 Murdock fully mounted .001 Mf.....                     | 4.50 |
| No. 368 Murdock fully mounted .0005 Mf.....                    | 4.00 |
| No. 3660 Murdock unmounted without knob and dial .001 Mf.....  | 4.00 |
| No. 3680 Murdock unmounted without knob and dial .0005 Mf..... | 3.25 |

## TELEPHONES

|   |      |
|---|------|
| No. 56 Murdock 2000 ohms.....           | 5.00 |
| No. 56 Murdock 3000 ohms.....           | 6.00 |
| No. 2A Stromberg Carlson 2000 ohms..... | 7.50 |
| No. P-1 Holtzer-Cabot 2200 ohms.....    | 8.00 |

Let "PITTSO" fill your orders for any of the above items.  
Our SERVICE on these at the present time will please you!

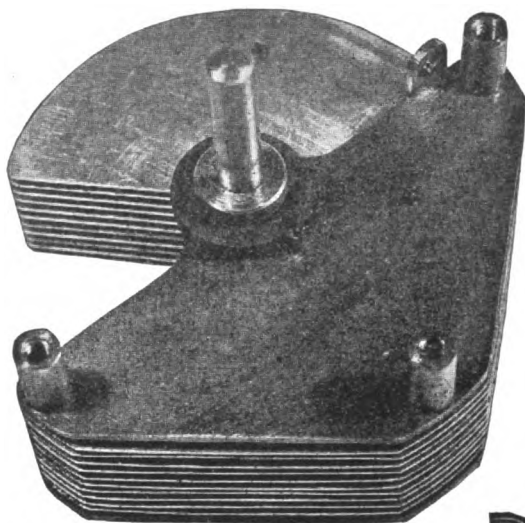
## PITTS RADIO STORES, INC.

12 PARK SQUARE, BOSTON, MASS.

Woolworth Bldg.,  
Providence, R. I.

3 Stores

276 Worthington St.  
Springfield, Mass.



### VARIABLE CONDENSER

Cat. No. 9519.....\$3.50

Knob and Dial.....\$1.00



Cat. No. 3333, \$3.50

## Radio Apparatus:

Variometer parts, wound and unwound.

Variometer complete with Knob and Dial.

V. T. Porcelain Socket.  
Made to fit any Tube.

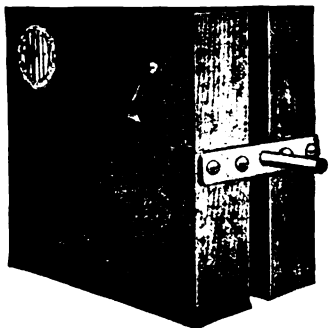
Wireless Ground Switch,  
100 amp. 5" Break, 600 V.

## Barber Electric Manufacturing Company

N. Attleboro, Mass.

Bulletin on request

## VARIOMETERS AND VARIOCOUPERS



These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base.

Variometer as illustrated ..\$6.00

Vario-Coupler as illustrated.. 6.00

Round or Square Base

Get them at your dealer's.

**SIMPLEX RADIO CO.**

1013-15 Ridge Av., Phila. Pa.



The **OGDEN WIRELESS LABORATORIES**

### THE O.W.L. RHEOSTAT

Patents pending

An instrument of real Value, NO THERMO-ACTION resulting in distortion because all parts are made of the same resistance alloy throughout.

**PRICE - - \$1.00**

1012 Ogden Ave.,

New York City

## DEL FELCO

Complete line of Amrad, Thordarson, Coto-Coil, Chelsea, Murdock, DeForest, Products. Complete installations a specialty.

**DELANCEY FELCH & CO.**

12 MEETING ST.

PAWTUCKET, R. I.

# Type "Q" Receiver

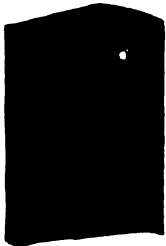


**AN IDEAL RECEIVING SET FOR LONG  
AND SHORT WAVE AND RADIO  
TELEPHONE RECEPTION**

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

**Price without Detector . . . . . \$35.00**

## Duck's New Radio Catalog No. 16



**Send 25c in coin carefully wrapped today for copy of the greatest radio catalog ever put between the pages of two covers.**

### ***275 Pages--A Catalog DeLuxe***

Never in the history of radio was such a catalog printed.

The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many books selling for \$2.00, and \$1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this catalog.

A brief summary of the radio goods listed in this catalog:

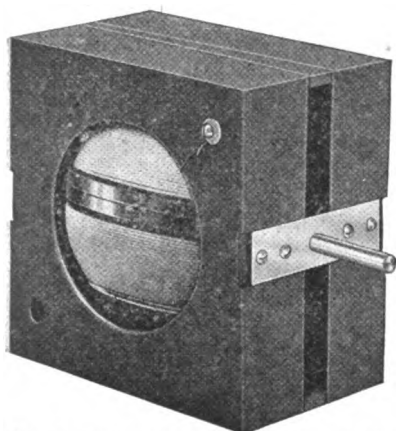
The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

Send 25c in coin, (carefully wrapped) for the new catalog. The great cost of this elaborate catalog prohibits distribution on any other basis.

## **The William B. Duck Company**

**243-245 Superior Street,**

**Toledo, Ohio**



We supply variometer forms in quantity lots to small manufacturers.

## AMPLITUNE

### Variometers—Variocouplers

These beautiful instruments will satisfy the ear and delight the eye of the discriminating amateur.

**VARIOMETERS, complete as illustrated . . \$4.35**  
**Unwired Parts, including hdwe . . . 3.05**  
**Winding form for stator . . . . . .75**  
 (Include Postage for 3 lbs.)

**VARIOCOUPERS, complete . . . . . \$3.75**  
**Unassembled parts, (primary wound) 2.90**  
 (Include Postage for 2 lbs.)

## !!! AMATEURS !!!

Pin a \$15.00 Money Order to this Ad. We will ship you **PREPAID** forms, hardware, etc. for the **HEARD AMPLITUNE SET**. This equipment includes material for 2 Variometers, Variocoupler, 3 Knobs and Dials, Tube Socket, Rheostat, Winding Form, Binding Posts, Switch, Switch-Points, Grid Condenser, and necessary Instructions to construct the **STANDARD REGENERATIVE SHORT WAVE TUNER AND DETECTOR**. **THE BIGGEST RADIO BARGAIN FOR THE AMATEUR WHO WANTS TO BUILD HIS OWN.**

**THE HEARD CO.**

**722 CHESTNUT STREET,**

**ST. LOUIS, U. S. A.**

### Our New Price List is Ready. Get Your Copy

Immediate deliveries on  
 Radio Corporation  
 Magnavox  
 Grebe  
 Amrad  
 Clapp-Eastham  
 Tuska  
 Formica  
 Thordarson  
 Remler  
 Cunningham  
 Frost  
 Federal  
 & Others

**Detroit Electric Co.**

113-115 E. Jefferson Ave.

**DETROIT,**

**MICH.**



### Firco Radio Apparatus

For sale by all prominent dealers

**JOHN FIRTH & CO., Inc.**

*Pioneers since 1901*

709 Sixth Avenue,

**New York**

Agents for the



**COLUMBIA RADIO  
 SUPPLY CO.**  
 808 19th St. N. W.  
 Washington, D. C.

### DX RADIO FREQUENCY TRANSFORMER

The secret of DX work. Makes coil aerial reception a reality. Its superiority is well established. Prove it for yourself. See p. 930, April-May, 1922 issue Radio News. . . .

Range 170- 450 meters \$8.00  
 Range 400-1200 meters \$8.00  
 Range 900-3000 meters \$8.00  
 Plug-in socket mounting \$1

# **The Wholesale Radio Equipment Co.**

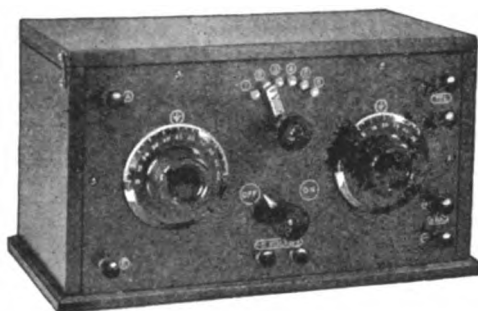
*Says*

## **DEALERS**

### **“Sample Our Service”**

*We Have On Hand For Delivery*  
**TUSKA POPULAR RECEIVER**

**Regenerative  
Type 224**



**Price  
\$35.00**

This outfit is ready for tubes, phones and batteries. It is **COMPLETELY MOULDED**. Ideal for expert or beginner. Two knobs: one for wave length; the other, for amplifying. Type 224 has stood the test of public trial.

**DEALERS:**

Orders filled promptly for this outfit,  
also other standard sets and parts.

**WRITE FOR PRICE LIST.**

## **THE WHOLESALE RADIO EQUIPMENT CO.**

**26 WILLIAM ST., NEWARK, N. J.**

*“ Wholesale Exclusively ”*

**A Symbol of  
Increasing  
Significance**



**Westinghouse  
Aeriola-Sr.**

**\$65**

**PAID  
POST**

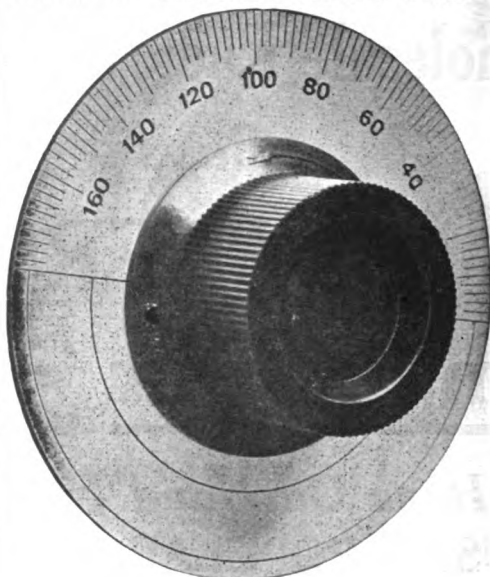
Complete with Brandes Headset and new Vacuum Tube—requiring but 2 amp. to heat filament and runs on a single 26 Dry Cell (50c) and small "B" Battery (\$1.75).

**REGENERATIVE CIRCUIT**

Range 500 miles with average antenna and ground system.

**PROMPT SHIPMENT**

**Insist on SOMERVILLE DIAL INDICATORS**



**Cost More Than  
Imitations—But Are  
Worth the Differ-  
ence.**

**PRICE**

**\$1.75**

for the 4" Dia.  
model and

**\$1.60**

for the new 3 1/4"  
dia. model

**POSTPAID**

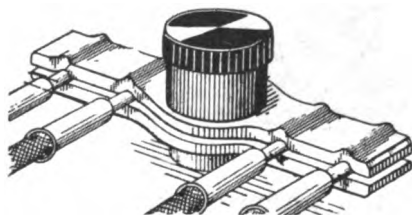
from us, or from  
your dealer.

New lot has dial in-  
sulated from shaft,  
so that dial may be  
grounded to act as a  
shield.

**SOMERVILLE RADIO LABORATORY**  
176-178 Washington St., Dept. QST  
Boston, Mass.

Send 25c for our *ENLARGED* Catalog!

**Why Pay More?**  
**SOMERVILLE**  
100V. C.W.  
Condensers  
**75c Postpaid**



**FOUR SETS OF PHONES**

**25c** will buy a set of Multiple Binding Post Connections (patent pending) which provide the only practical means of attaching as many as 4 pairs of telephone receivers to a pair of ordinary binding posts.

Dual connection set provides same connection in attaching Magnavox and outfit to storage battery.

Either set will be sent postpaid upon receipt of 25c in coin or stamps. Satisfaction guaranteed or money back.

**Portable Wireless Telephone Co.**

Dep't B, Commercial Bank Bldg.,

**STOCKTON, CALIFORNIA**

Attractive Dealer's Proposition



**SOUTHERN RADIO CORPORATION**

Radio Engineers and Jobbers

905 Realty Building.

Charlotte, N. C.

Head  
Receivers  
Micro-  
Phones



Keys  
Jacks  
Plugs  
Etc.

**HIGH GRADE  
WIRELESS APPARATUS**

Manufactured by

**American Electric**  
COMPANY

State and 64th Sts., Chicago, U.S.A.



It's easy, make you own  
**INDOOR COIL AERIAL**  
Drawing, R. F. amplifier circuit, chart and tables giving proper number of turns to put on coil for any wavelength. Complete data covering 0 to 24,000 meters on 3 large sheets. \$1.00. Stamps not accepted.

**C. A. DAVIS & COMPANY**

2371 Champlain St., Washington, D. C.



75c  
EA.



## KELLOGG V-T SOCKET

*the durable socket*

Kellogg molded lamp sockets fit all standard four prong based vacuum tubes. Extra heavy solid base  $\frac{1}{8}$  inches thick. Four German silver springs with rounded ends firmly held in position in deep grooves, cannot touch mounting surface. Double end nickel plated binding posts. Connections can be made under the socket as well as above. A practically indestructible construction. 75c each, postpaid.

### COMPLETE RADIO EQUIPMENT

The item above is merely a sample of the excellent line of radio equipment that is handled by the Apex Radio Company, Inc. All orders for sockets or other standard equipment will be filled the day received. Send two cent stamp for our new price bulletin.

**APEX RADIO CO., Inc.** Dept. Q-1  
1105 W 69th St.  
Chicago, Illinois

## WRITE US FOR RIGHT PRICES

The best of apparatus and supplies at reasonable prices. We sell direct to the amateur, Grebe, Murdock, DeForest, Acme, Baldwin, Jewell, Brandes and other high grade lines. Tell us your needs and let us quote prices and delivery.

*Write to Us Today*

**Garber Radio Electric Co.**  
Metamora, Ill.

## NEW MOTORS

FOR ALL PURPOSES  
STANDARD MANUFACTURERS  
PROMPT DELIVERY

ALL SIZES UP TO 5 H.P.

**We Specialize In Small Motors & Generators**

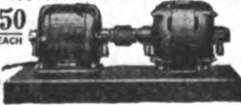
ALL PHASES AND FREQUENCIES IN STOCK AT ALL TIMES  
Largest exclusive Mail Order Small Motor dealers in the world.

CHAS. H. JOHNSTON, Box 119, West End, Pittsburgh, Pa.

**WIRELESS, TELEPHONE GENERATORS**  
500 VOLT - 100 WATT - 3400 R. P. M.  
FOR MOUNTING MOTOR GENERATOR SETS.

**\$28.50**  
EACH

WRITE FOR  
CATALOG



## FROM CAT WHISKERS UP—

We can supply everything that's best in Radio, or any article to use or dealer. Same day shipments.

*Inquiries are welcome*

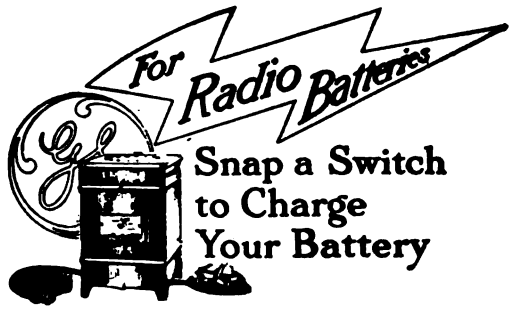


**DISTRIBUTORS**  
Wholesale and Retail

WESTINGHOUSE MURDOCK  
RADIO CORPORATION  
BRANDES, FEDERAL, DEFOREST  
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



**Snap a Switch  
to Charge  
Your Battery**

If you have a radio receiving set using a storage battery, haven't you often wished for a simple efficient means for recharging this battery without lugging it away to a service station?

# Tungar

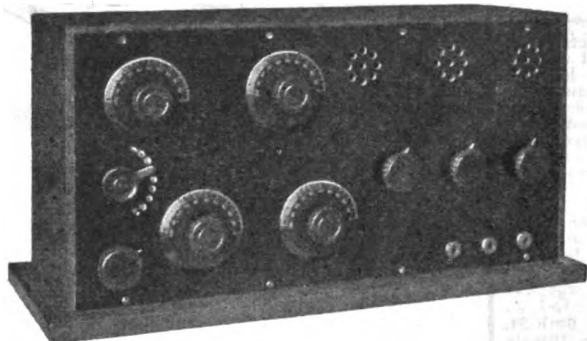
BATTERY CHARGER

charges storage batteries from any alternating current lighting circuit with a minimum of expense and trouble. You can do your charging right in your own home and without lifting the battery from its present position.

The Tungar is not new—thousands have been used for charging automobile starting and lighting batteries for years. Tungar has no moving parts to wear out or require oil. It requires no attention while charging but may safely be left on the battery all night.

If your dealer in radio or other electrical supplies does not carry Tungar, write us and we will send you literature and tell you where you can get one.

**General Electric Company**  
General Office  
Schenectady, NY  
Sales Offices in  
all large cities



# ANNOUNCING

## The New Radio Audio Frequency Receiver Amplifier

**Type L100**

150-600 Meter Supersensitive Receiver Amplifier. Two stage radio frequency, Detector and two stage audio frequency Amplifier. Sets are furnished with 5 A.P. Tubes and B. Batt. Tuning is accomplished by variable condensers and regeneration. Set is equally efficient on C.W., Spark or Phone. Tubes are placed in two rows, three in the first row, two in the second row. Set is combined in one cabinet 9 1/2" x 19"

The radio frequency amplification makes it possible to use a loop aerial with best efficiency. Therefore it may be used in apartments and homes where outside aerials are not desired.

*Send for descriptive literature.*

**TYPE L100 RECEIVER AMPLIFIER.....\$165.00**

### Saginaw Radio Service

407 No. Porter Street,

**SAGINAW,**

**MICHIGAN**

### Vacuum Tube Detector \$5.50

Including complete cabinet with all instruments wired ready for use.

**DETECTOR AND TWO  
STAGE AMPLIFIER  
\$22.50**

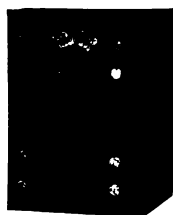
With transformers and all other instruments in cabinet, ready for operation. This equipment is of high quality, and distances of as high as 3000 miles have been obtained with ease.

**BATTERIES AND TUBES  
EXTRA**

**2000 Ohm receivers \$5.00  
SUPERIOR CRYSTAL  
RECEIVING SET \$4.75**

*Attractive dealers proposition*

**STEINMETZ WIRELESS MFG. CO.,  
5706 PENN AVENUE, PITTSBURGH, PA.**



### Send Us Your Orders For

Variable Condensers, Variometers, Variocouplers, Loose Couplers, Tuning Coils, Amplifying Transformers, Sliders, Switches, Switch Points, Binding Posts, etc.

We are large manufacturers. Gorton machine engraving or manufacturing special parts to order.

**F. JOS. LAMB COMPANY**

1938 Franklin St., Detroit, Michigan

### July Clearance Sale

# RADIO

Sets—Outfits—Parts

**Lowest Prices Ever Offered**

*Write us your wants and save money.*

*Catalog sent on receipt of 10c.*

**AMERICAN ELECTRO TECHNICAL APPLIANCE CO.  
227-229 Fulton St., New York**

### SPECIAL PRICES THIS MONTH

On Grebe, Clapp-Eastham and  
Amrad Sets

**MASSEY RADIO COMPANY**

The Radio Store, Winchester, Va.

## RAY-DI-CO

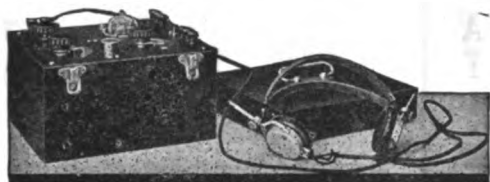
Radio Supplies for Service and Satisfaction  
Write, wire or phone us for prices and information

**RAY-DI-CO Organization**

1547D N. WELLS ST., CHICAGO, ILL.

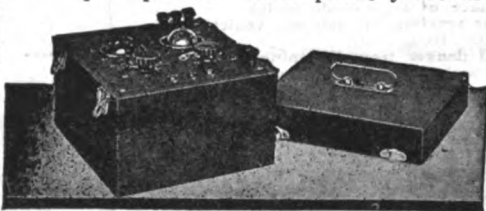
## To Receive Broadcasting Radiophones

### The Radiohome Receiver



The Radiohome Receiver

We illustrate two pieces of radio receiving apparatus which will, doubtless, appear unfamiliar to the amateur field. Yet we have been manufacturing these sets for some time—for the general public. The Radiohome Receiver has a simple, two-slide tuning circuit with a range of 145-800 meters, a vacuum tube detector, and grid leak and rheostat. The price—less tube, batteries, receivers and antenna—is \$36. In a cabinet that is identical in size and finish with the cabinet of the Radiohome, is the DT-800, two-step amplifier. Three phone jacks are embodied in this instrument for detector, 1st step and 2nd step. Less tubes and batteries the price is \$35. We believe you will find no other set on the market to compare with this combination for the reception of radiophone programs by the newcomer in the field.



The DT-800 Two-Step Amplifier

### The DT-800 Amplifier

Every amateur is frequently being asked for advice as to what set should be purchased for the reception of radio telephone programs of music, news and stories. Many an amateur hesitates to recommend standard amateur equipment as his friends would be confused and bewildered by the array of controls on such a set.

**DeForest Radio Telephone and Telegraph Co.,** NEW YORK CITY

## WIRELESS TELEPHONE AND RADIO APPARATUS

(Complete Sets)

### CLARK & MILLS ELECTRIC COMPANY ELECTRAGISTS

75 Newbury St., BOSTON  
Tels. Back Bay 365 & 366 & 8296  
1444 Massachusetts Ave., CAMBRIDGE  
Tel. University 1169

### RADIO REALITIES

Our price list, mailed Free on request. Contains complete lists of reliable Radio Sets and parts—every article carrying our guarantee. Mail orders given prompt attention.

Write today—Special Terms for Dealers

### THE KLEIN RADIO & ELECTRICAL SUPPLY CO.

48 Fulton St. and 34 Park Place NEW YORK, N. Y.

## STOP USING A TRUSS



Reduced  
Fac-Simile  
Gold Medal

STUART'S PLAPAO - PADS are different from the truss, being medicine applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered.

Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending trial of Plapao absolutely **FREE**. Write name on Coupon and send TODAY. **PLAPAO CO., 955 STUART BLDG., ST. LOUIS, MO.**  
Name .....  
Address .....  
Return mail will bring Free Trial Plapao.....

Reduced  
Fac-Simile



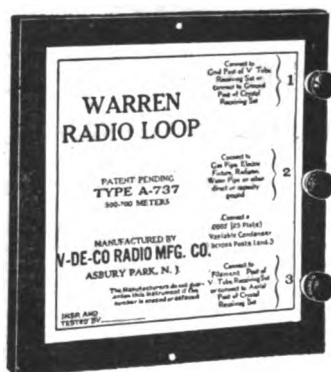
Grand Prix

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# Warren Radio Loop

NO  
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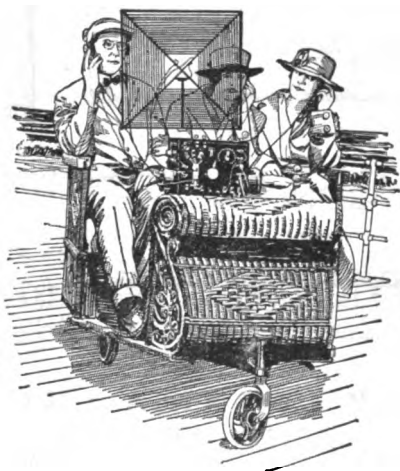
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If Dad says—  
"NO AERIAL ON THIS HOUSE"  
don't allow his QRM to worry you but  
purchase a

## WARREN RADIO LOOP

The LOOP that made the Radio Roller Chair famous on the Boardwalk at Asbury Park, N. J. is just the thing for an apartment or den. Is light in weight and easily portable. Is produced under a new principle of winding. Is wholly enclosed, thereby protecting the winding. Is used in place of an outside aerial. Is adapted for receiving in moving vehicles. Takes the "tic" from static. Eliminates all danger from lightning. Can be used with any receiving instrument. Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on "Wireless Age" and "Radio News" and featured in many other magazines and newspapers in the United States.

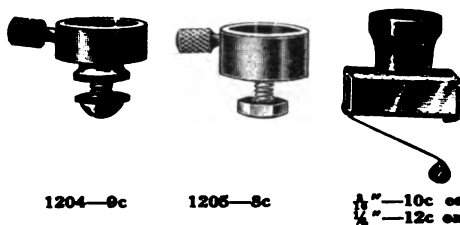
Send your order through your dealer or direct to us with his name.

Type-A-737 (300-700 meters) .....\$10.00  
Type-A-7236 (175-1000 meters) ..... 12.00

## V-DE-CO RADIO MFG. CO.

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. A101



## CRYSTAL DETECTOR STAND Crystal Detector Stand, No. 1200

Nickel plated or brass finish  
No. 1201—\$1.50  
Tested Galena in Wood's metal 20c.  
Get prices for other instruments and parts  
Dust-proof. No vibration. Flexible adjustment. Can be set rigidly.  
Get our prices for Switch Points, Binding Posts and other parts.

## Audion Bulb Socket, No. 1150

latest in absolute reliable contacts. Study construction shown in diagram. "ON TOP OF ALL" quality, and sets for \$1.00 only. Highly nickel polished and polished black compo base.

## Rheostat, No. 1175

is constructed with metal bearing for shaft, therefore more durable than others. Designed for use on panel or table. Resistance 5 ohms \$1.00 postpaid.

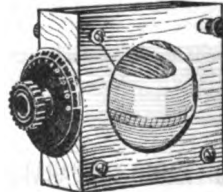
5c ea. 100—\$4.00  
40c ea. 100—\$25.00

70c. ea. 100 \$48.00  
3" Compo Dial  
For left and right rotation  
No. 69 1 1/2c ea. 100 95c.



\$6.50 per 1000 N. P.; \$9.00 for 1000 N. P. or brass  
All styles of Binding Posts and Radio Parts manufactured and carried in stock. Get illustrated folder.  
CONTINENTAL ELECTRIC CO.,  
117 E. 129th Street, N., New York, N. Y.

## FRANKLIN VARIOMETER



Made of selected hardwood. Permanent contacts assure smoothness of operation, unsurpassed by any other make.

PRICE \$4.50

Sample sent prepaid \$3.50

Dealers write for Discounts.

## FRANKLIN RADIO MFG. CO.

711 Penn Ave.,

Wilkesburg, Pa.

## BUILD YOUR OWN RECEIVER

Combination No. 50 consists of 2 B-K variometers, 1 B-K variocoupler, complete with dials, 1 FADA inductance switch, 10 contact points, 2 switch stops, 6 nickel plated binding posts, 9 feet nickel plated connecting wire. All ready to mount on your own panel.  
PRICE \$18.00 postpaid

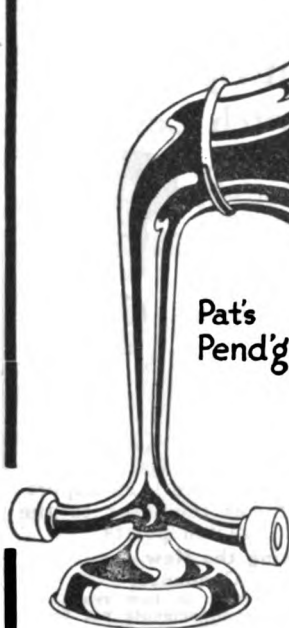
Write for Bulletin No. 1

BONDUAU & KNIGHTS

1115 Kelly Street,

Bronx, N. Y.

Price \$12.00 F.O.B. N.Y. City



Pat's  
Pend'g

# INTRODUCING THE KING "AM-PLI-TONE" A RADIO SURPRISE

**Listen to the Concerts, News and Dance  
with a KING "AM-PLI-TONE."**

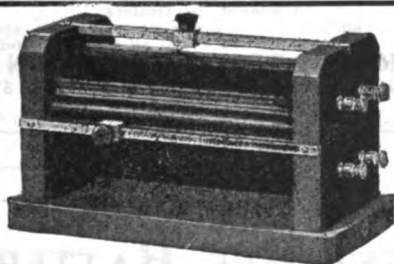
Just slip your head phones on the "AM-PLI-TONE" and you and your friends will be SURPRISED.

Polished Cast Aluminum Body with Nickel Plated Base and Horn. No sheet Metal is used, the "Tinny" Sound is Left Out. The VOLUME is DOUBLED because TWO head phones are blended into one POWERFUL tone.

NOTICE: All infringers of this device will be vigorously prosecuted.

A big hit—a big seller and immediate deliveries. Dealers and distributors what more can you ask? Write today for territory—KING "AM-PLI-TONE"

82 Church St., New York City



LAMB TUNING COILS. Two Nickel sliders and rods; four nickel binding posts. Coil contains about  $\frac{1}{2}$  #22 enameled magnet wire. Mounted in hard wood ends and base. Price \$3.00.  
 $\frac{1}{4}$ " Sliders—Brass 20c; Nickel 25c.  
 $\frac{1}{4}$ " Slider Rods—Brass 15c; Nickel 20c.  
 Crystal Detectors, nickel plated on Mahogany Base, \$1.00.  
 Crystal Detectors, glass case and fibre base, \$1.25.  
 Contact Points, threaded with nuts—20c dozen  
 Compo. cap, Nickel base Binding Posts—7c each.  
 Plain Nickel Binding Posts—3 $\frac{1}{2}$ c each.

IMMEDIATE DELIVERIES  
Liberal discounts to dealers

**F. JOS. LAMB COMPANY**

1938 Franklin St., Detroit, Michigan

## Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

### SPECIAL!

|   |        |
|---|--------|
| Vacuum Tube Sockets.....                  | \$1.25 |
| Rheostats .....                           | 1.25   |
| 22 $\frac{1}{2}$ Volt "B" Batteries ..... | 1.50   |
| Rasco Dials .....                         | .60    |
| Rubber Binding Posts .....                | .20    |
| Tested Galena .....                       | .40    |

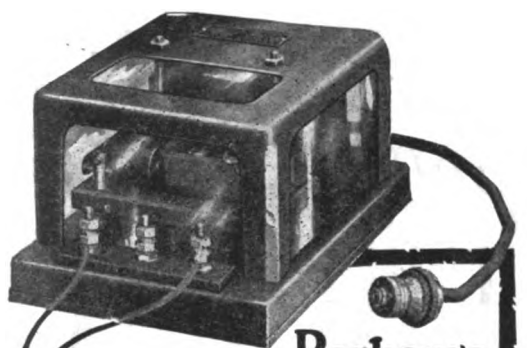
Lateral Wound Coils. All Sizes

SEND 5c FOR OUR NEW PRICE LIST

**J. M. PAQUIN,**

THE ELECTRICAL SHOP

787 Queen St. West, Toronto, Ont.



## Recharge Your Battery at Home

### Charges both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a Valley Charger and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge it or harm it in any way.

Will charge the A 6 volt battery at a 5 ampere rate, and the B 22½ volt battery at the required ½ ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged.

### SATISFACTION GUARANTEED.

If your local distributor cannot supply you, write direct to  
**VALLEY ELECTRIC COMPANY,**  
Department Q, ST. LOUIS, MO.

----- Mail the Coupon -----  
Valley Electric Co., Dept. Q, St. Louis, Mo.

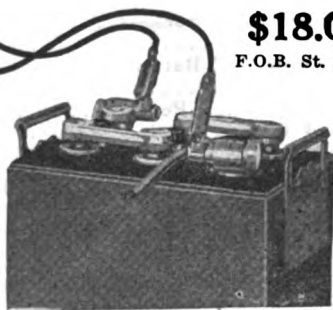
Gentlemen: I am enclosing money order (or check) for \$18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, I will return it and get my money.

Name \_\_\_\_\_

Address \_\_\_\_\_

**\$18.00**

F.O.B. St. Louis



# RTS

## Equipment Specialties RTS Switch Lever

The attention of jobbers and dealers is especially called to the RTS Bushing Lever made to retail at 60



cents. It has many improved features. The knob is of the well known Marconi type, 1¼ inches in diameter. The spring lever of nickel bronze has ground ends, insuring smooth and positive adjustment. It has a ¼-inch bushing and locknut for panel assembly. A guide bushing under the knob is an important feature as it raises the lever to the proper height for all switch points.

### Announcing the New RTS Grid Condenser

The new RTS Grid Condenser is now ready for delivery. Contains many improvements not found in other types. Capacity .0005 M. F., price to retail at only.....38c each.

### RTS Phone Condenser

RTS Condensers need little description. Their accuracy and simplicity have made them universally popular. The RTS phone condensers, capacity .0018 M.F., complete with binding posts ready for connection, to retail at.....35c each

### RTS Grid Condenser and Grid Leak

Combined. Made for those who desire the best. Price each.....45c

### RTS Rubber Binding Posts

These posts are as good as any you can find. Bushing heavily nickel plated. Give the amateurs' instruments the appearance of a first class outfit. 12c each or \$1.25 a dozen

### Discount to Dealers

Dealers and Jobbers: Write us today for special quotations and discounts on all RTS equipment.

## RADIO TESTING STATION

DEPT. R-7. 25 STURGIS ST.  
BINGHAMTON, NEW YORK

## BEST BEE BATTERY

24 Cell—Storage

Electrically Welded Elements  
Packed Complete with Instructions

**\$7.50**

From Your Dealer or From Us  
Parcel Post Prepaid—At Once

**A. C. TOWNE, Inc.**  
21 TERRACE—BUFFALO, N. Y.



# CROSLEY



**HARKO SENIOR NO. V**



**2 STEP AMPLIFIER**

## Crosley Harko Senior V Receiver

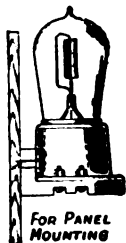
The Crosley Harko Senior Receiver No. V. has been greatly refined as to detail, hook-up, etc., and is a remarkably efficient tuner and detector unit capable of bringing in concerts and signals from surprising distances. It is non-regenerative, which means easy to tune without distortion. Manufactured in large quantities in our own factories makes the low price possible. Cabinet work, Adam brown mahogany finish. Newest refinements in design of panel fittings, including molded knobs and dial. Price.....\$20.

## Crosley 2 Step Amplifier

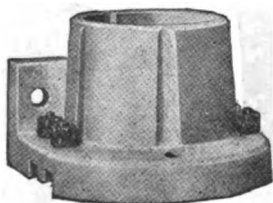
The Crosley 2 step Amplifier. A most efficient piece of apparatus especially when hooked up with the Harko Senior V., but giving excellent results with any audion receiving set. Contains two celebrated Crosley V. T. Sockets, Crosley Rheostats and Crosley Sheltrans (new design transformers), Cabinet matches Harko Senior V. in wood and size. Niceties of design and finish are the same in both instruments.

**WLW** **RADIO** **APPARATUS**

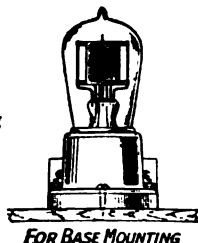
# CROSLEY



For  
Panel  
Mounting



For  
Base  
Mounting



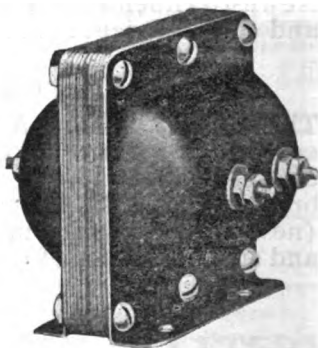
FOR BASE MOUNTING

## The Celebrated Crosley V.T. Socket

A practically unbreakable socket of porcelain which because of its high dielectric value is the most desirable socket material. Not only does it eliminate possible ground hums but permits soldering of wire connections. The bayonet slot is reinforced and the contacts are nicked and positive. It is designed for base or panel mounting and at twice the price is a remarkable piece of radio apparatus. Crosley "Better—Costs Less", Price 50c.

## Crosley Sheltran

In this piece of Crosley apparatus we have a completely shielded transformer, a feature to be sought in this important radio part. Its design has proven highly efficient in obtaining maximum amplification from modern vacuum tubes. Its ratio is 1 to 9. Net weight 12½ oz. Area 1¼x2½." Price \$4.00



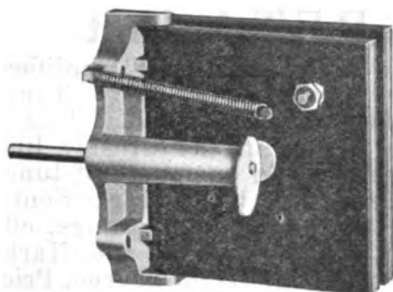
**"BETTER**

**- COSTS LESS "**

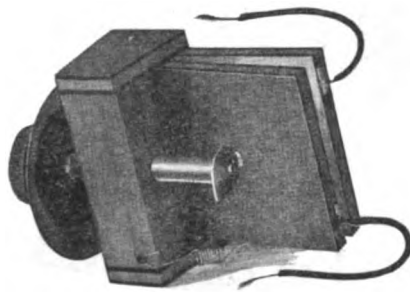


# CROSLEY

**MODEL B**



**MODEL A**



## Variable Condensers

**MODEL B**

Crosley Variable Condensers because of their quantity production and simple construction are almost unbelievable at the price. Not alone this, but we claim and substantiate this claim by laboratory tests in one of the country's leading universities. And in practical support thousands of users through the United States attest to their efficiency and value. Model "B" condenser, .0005 mf. capacity, die cast frame, laminated wood panels. Price without knob and dial, \$1.75.

**MODEL A**

In Crosley Variable Condensers it will be noted that the contacts of both plates are positive, eliminating to a great degree the internal resistance that develops in a short time, in the air type condenser from corroded spring contacts, etc. Variation is accomplished thru the book action of the plates by a cam. Each Crosley Variable Condenser is tested to withstand 1000 volts before shipment. Short circuiting is impossible. Model A is conservatively rated at .0005 mf. capacity. Laminated wood frame and plates. Price without knob and dial, \$1.25.

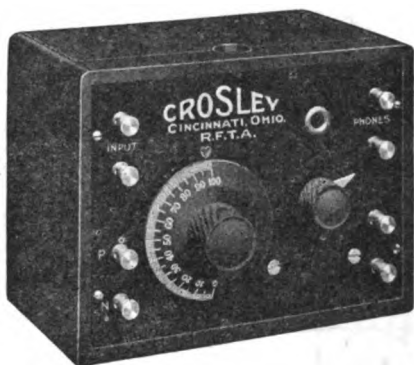
## Crosley Model C Variable Condenser

Crosley Variable Condensers are superior to the interlocking type for this reason: depending upon the air for dielectric the necessarily wide gap between the plates means low capacity for given unit of plate area. Mica is the insulation between plates of the Crosley type condenser and will stand much higher voltage than the average air condenser. Its safety for C.W. work is readily apparent. Model C, constructed with porcelain plates. Capacity runs from .001 to .0018 mf. Price without knob or dial, \$2.25.

**RADIO**

**APPARATUS**

# CROSLEY



## The New Crosley R.F.T.A. Unit

(Radio Frequency Tuned Amplifier)

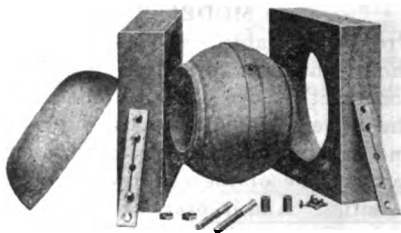
Crosley Radio Frequency Tuned Amplifier, R.F.T.A. unit. This is a new comer in the Crosley line, designed to add one stage of tuned radio frequency to the Harko Senior No. V. It increases the range, efficiency and volume of the Harko Senior to a wonderful degree. Price \$15.

Write for further details of this new unit.

## Variometer Parts

Made in great quantities in our large wood working factory. Crosley Variometer parts are accurate, of neat design and very moderately priced. Stator and rotor forms are furnished complete with all necessary hardware for assembly according to individual ideas.

Made of poplar wood and nicely  
shellaced.....\$1.50  
Winding form......30



## Crosley Vario-Coupler Parts

The Crosley Vario-Coupler parts consist of a mica tube, rotor and the necessary hardware for complete assembly. All parts are made with great accuracy and can be assembled perfectly and neatly. Rotor diameter is  $3\frac{1}{2}$  inches. Tube lengths  $2\frac{1}{2}$  inches. Tube diameter  $3\frac{3}{16}$ ". All parts complete with necessary hardware, \$1.50.

"BETTER

- COSTS LESS "

# RADIO EQUIPMENT FOR IMMEDIATE DELIVERY

## PHONES

|                 |        |
|-----------------|--------|
| Federal 2200    |        |
| ohm .....       | \$8.00 |
| Federal 3200    |        |
| ohm .....       | 10.50  |
| Dictograph      |        |
| 3000 ohm ...    | 12.00  |
| Brandes         |        |
| Superior ....   | 8.00   |
| Everett 3000    |        |
| ohm .....       | 7.50   |
| Stromberg ....  | 7.50   |
| Baldwin attach- |        |
| ments for all   |        |
| phonographs     | 15.00  |
| Murdock 2000    |        |
| ohm .....       | 5.00   |
| Murdock 3000    |        |
| ohm .....       | 6.00   |

## Phone Posts

Each 7c or 77c doz.  
 Contacts—three sizes,  
 nicked, Doz. 30c  
 per 100.....\$2.50

## TUBES

|                  |        |
|------------------|--------|
| Radiotron        |        |
| UV 200 ....      | \$5.00 |
| Radiotron        |        |
| UV 201 ....      | 6.50   |
| Cunningham       |        |
| C 300 .....      | 5.00   |
| Cunningham       |        |
| C 301 .....      | 6.50   |
| A. P. Detector.. | 5.00   |
| A.P. Amplifier.  | 6.50   |

## VARIABLE CONDENSERS

|                |        |
|----------------|--------|
| Chelsea NL 3.. | \$4.75 |
| Chelsea NL 4.. | 4.25   |
| Arco 11 .....  | 3.50   |
| Arco 23 .....  | 4.25   |
| Arco 43 .....  | 4.75   |

## SETS

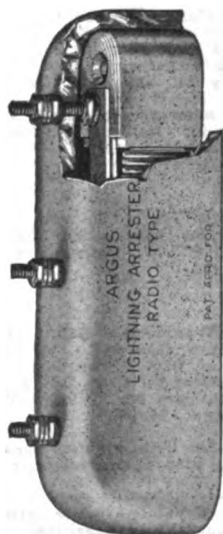
|                |         |
|----------------|---------|
| Grebe CR 5..   | \$80.00 |
| RORK           |         |
| Amplifier ..   | 55.00   |
| Grebe CR 9..   | 130.00  |
| Westinghouse   |         |
| RA Tuner ...   | 68.00   |
| DA Amplifier.  | 68.00   |
| Aeriola Sr. .. | 65.00   |
| R-3 Magnavox   | 45.00   |

## AERIAL WIRE

|                  |     |
|------------------|-----|
| Solid 100 ft.... | 40c |
| Stranded 100 ft. | 59c |

Purchases sent prepaid to your nearest shipping point to within 500 miles of Pittsburgh.

Established 1868 **THE ROSENBAUM** CO. PITTSBURGH, PA.



## Dealers and Jobbers WANTED

We can make immediate  
shipment.

For the Argus Light-  
ning Arrester Radio  
type Accepted by the  
Underwriters' Labora-  
tories.

List at \$1.50  
Big Seller

**SURE—SAFE—AND  
SUBSTANTIAL**

Weather Proof—  
Porcelain Cover

**WRITE US TO-DAY**

**The Radioart  
Supply Co., Inc.**

132 So. Howard Street,  
AKRON, OHIO

## WIRELESS CATALOGUE

Whether you are interested  
in a complete radio receiving  
outfit, or a half a dozen  
binding posts, you'll find the  
particular instrument, best  
for your needs, in Corwin's  
catalogue. Send 10 cents,  
(credited to your first order)  
for your copy today!  
Where's the nearest mailbox?

**A.H. CORWIN & CO.**  
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Newark New Jersey

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Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 10th of month for succeeding month's issue.

**WEST COAST** signals all over the room with 4GL radio frequency transformers. Range 200-800. Price \$3.15 each with circuit. Savannah Radio Shop, 1223 East Duffy St., Savannah, Ga.

**SELL:** 1/2 K. V. A. Thordarson, \$15; 2 Saco Clad Amplifier transformers \$3 each; Murdock O.T. \$3.50; Remler Amplifier panel, \$4; Transmitting Oil Condenser, \$4. W. J. Baker, R. 15, Dayton, Ohio.

**IMMEDIATE DELIVERY**—Clapp-Eastman tuners and amplifiers—types H.R. and H.Z. Remler goods of quality. Everything in the line of parts. Write for complete lists. R. D. Briggs, 32 Cutler St., New London, Conn.

**TRIPLE GEAR** honeycomb coil regenerative receiver including coils and Radiotron Detector \$60.00. Box 205, Williamsport, Pa.

**WANTED:** Grebe CR-7. Must be in good order and cheap. What have you, Cash is waiting for best offer. Burrow, Box 613, Teague, Texas.

**RUBBER STAMP** with large call letters 50c; Radiogram and Relay Radiogram blanks 25c per hundred. Post cards 60c hundred. Send us your orders. Carolina Printing & Stamp Co., Wilmington, North Carolina.

**IMMEDIATE DELIVERY**—Radio Magnavox R-3 Westinghouse Storage "B" Batteries \$6.80; Detector and two step amp. in cabinet \$35.00; Moorhead detector and amp bulbs \$5.00 and \$6.50. Cheesaning Electric Co., Cheesaning, Mich.

**SHORT WAVE RECEIVER** in hinged oak case. Primary, secondary and coupling variable. Regular vacuum tube apparatus but supplied with crystal detector, with terminals for audion or amplifier. Complete with 2,000 ohm headset and aerial equipment \$35 postpaid. Set alone, \$25. Oak cases with hinged lids. Just the thing for portable sets or wavemeters. Size, six by nine by eight high, \$3.00. With condensate coloron panel \$3.85. Crescent Radio Laboratory, 1200 North 29th Street, Philadelphia, Pa.

**SELL:** Variometer set, detector and three step with bulbs and "B" Battery. Other apparatus. Morris Decker, Baldwinville, N. Y.

**PRINTED CARDS**—Description of your station with QRA. 500, \$4.00; 1000, \$6.00, delivered. Samples on request. Donald Detwiler, 3BSB, 1120 Virginia Ave., Washington, D. C.

**TRANSMITTING PARTS** to be sold below cost—Three essential parts of excellent Transmitting Set, in perfect condition and excellent working order, to be sold as a whole or separately. Motor Generator set with synchronous disc discharge—\$80.00; Switch Board, \$25.00; Transformer—2KW 240 cycle—\$20.00. Only one of each item. Write at once for details if interested. Doubleday-Hill Electric Co., 719 Liberty Ave., Pittsburgh, Pa.

**SELL**—Improved Reimartz tuner \$20. Det. and two-step \$65. Beverly Dudley, 4909 Fletcher St., Chicago.

**C.W.** Transmitter, motor generator, filter, chopper, microphone, key, Thermo ammeter, Voltmeter, plate ammeter, transformer, 7 1/2 V—1000 V., hard rubber panel, quick change over C.W. buzzer, chopper, self-rectified C.W., voice, excellent order, \$200.00, J. E. Egleson, 12 Felton Ave., Ridley Park, Pa.

**FOR SALE:** Westinghouse Dynamotor, Motor 10 volts, Gen. 350 volts Army type \$25. 2 Stage Multiaudiphone Loud Speaker Complete. Cost \$75.00. Sell \$25. Fiske, Eastern Parkway, Brooklyn, New York.

**FOR SALE:** Grebe type CR-6 and Grebe CR-7 receivers; DeForest multi-wave tuner; 25 honeycomb coils; Grebe detector; Grebe two stage amplifier; Radiotron detector and amplifier tubes; Radiotron 8 watt power tubes; Edison storage batteries; New Eveready 100 volt B batteries; Wireless Specialty Apparatus Co. Type QS-500 1/2 KW transmitter. All sold

cheap and delivered promptly. Mack Guyton, Cotton Plant, Missa.

**SPECIAL:** Switch levers, complete with knob, bushings, etc., 1 1/4" radius, \$0.35 coin. Walter R. Haase, 779 E. 99 St., Cleveland, O.

**EDISON NICKLE ALKALI CELLS** for "A" Batteries: 1.3 volts 225 ampere hours \$6.50. (Three of these cells will run a V.T. 1 for 250 hours) 6.5 volts 225 ampere hours \$30. F.O.B. New York City. Edison B Battery elements 6c per set postpaid. A. J. Hanks, 606 Montgomery St., Jersey City, N. J.

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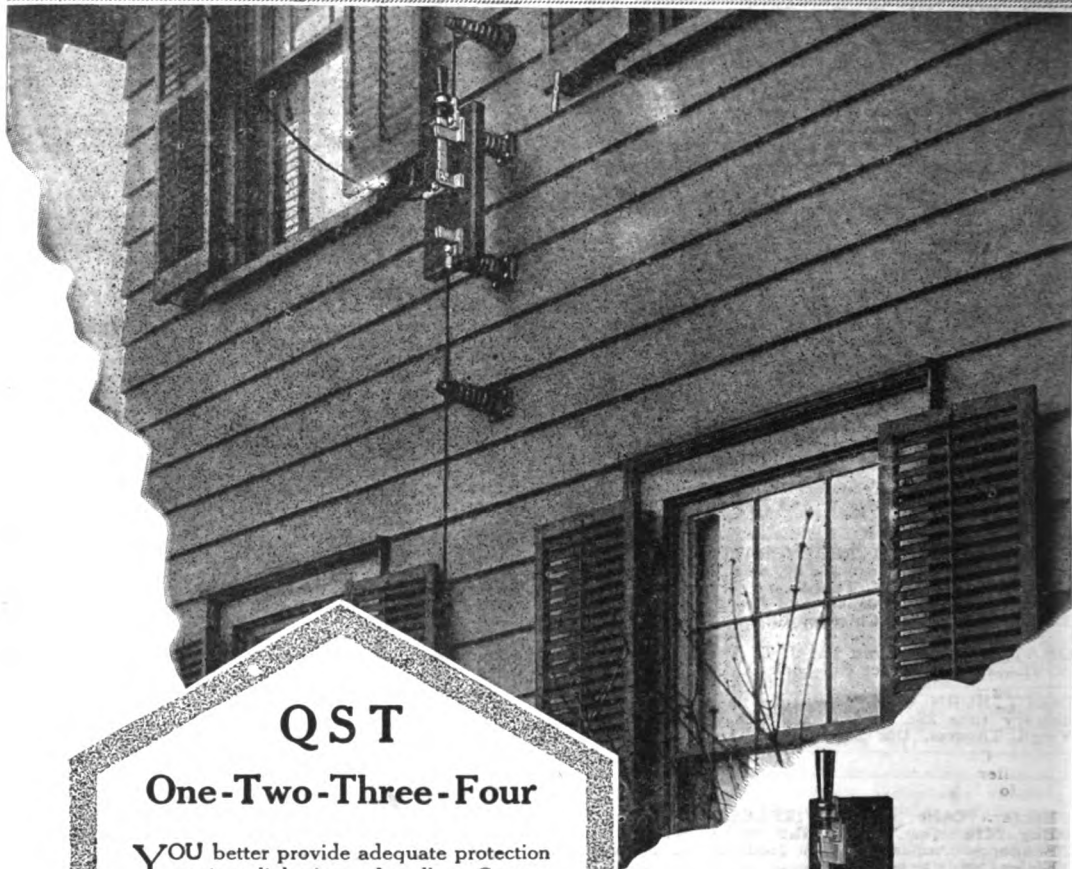
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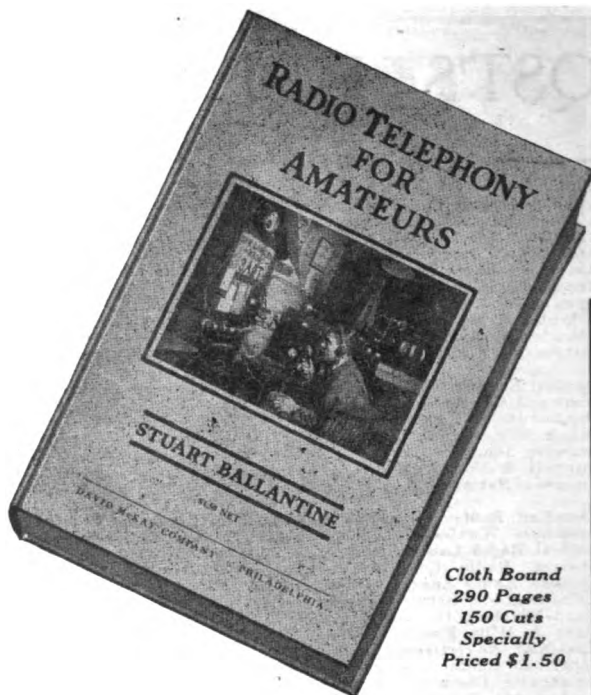
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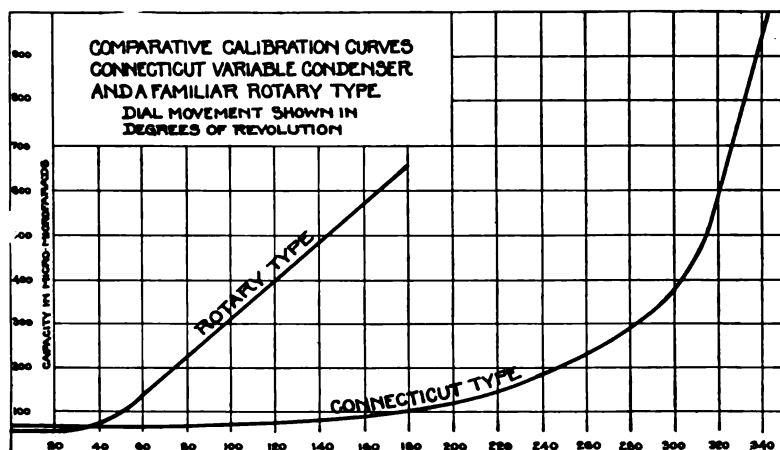


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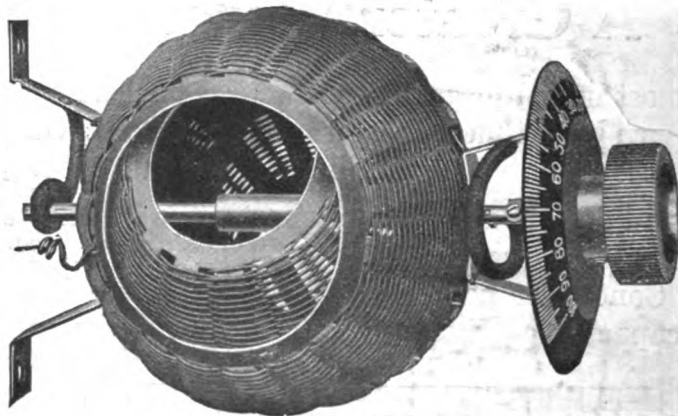
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